December 16, 1963

Aviation Week & Space Technology

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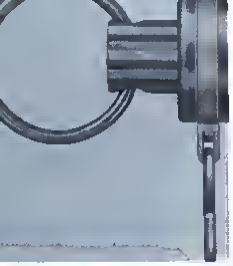
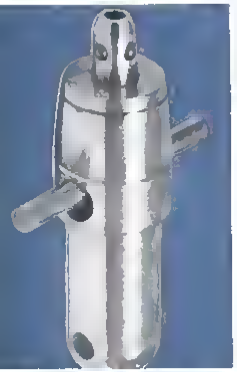
SPECIAL REPORT:

Gemini Paraglider

Lockheed XV-4A VTOL Hummingbird Hovering

Metal Cutting Begins on ELDO Third Stage





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AEROSPACE CALENDAR

Dec. 30—Annual Meeting, American Assn. for the Advancement of Science, Cleveland, Ohio.

Jan. 7-9—Tenth National Symposium on Reliability and Quality Control, Statler Hilton Hotel, Washington, D. C.

Jan. 13-17—Society of Automotive Engineers Automotive Engineering Congress & Exposition, Cobo Hall, Detroit, Mich.

Jan. 19-23—16th Annual Convention, Helicopter Assn. of America, San Marcos Inn, Chandler, Ariz.

Jan. 20-22—Aerospace Sciences Meeting, American Institute of Aeronautics and Astronautics, Hotel Astor, New York.

Jan. 21-24—Second International Arms Control and Disarmament Symposium, Ann Arbor, Mich. Sponsors: University of Michigan; The Bendix Corp.

Jan. 25—Seventh Annual Inland Empire Quality Control Conference, American Society for Quality Control, California State Polytechnic College, Pomona, Calif.

Jan. 27-28—Second Annual Symposium on Fundamental Phenomena in the Material Sciences, Sheraton Plaza Hotel, Boston, Mass. Sponsor: Ilikon Corp.

Jan. 27-29—Conference on Control and System Optimization, Monterey, Calif. Sponsors: Society for Industry & Applied Mathematics; American Institute of Aeronautics and Astronautics; Institute for Mathematical Statistics; U. S. Naval Post Graduate School.

Jan. 27-30—20th Annual Technical Confer-

(Continued on page 7)

AVIATION WEEK & Space Technology

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AEROSPACE CALENDAR

(Continued from page 5)

ence Society of Plastics Engineers, Chalfonte Haddon Hall Hotels, Atlantic City.

Jan. 27-30—Applications Forum on Antenna Research, University of Illinois' Midwest Electronics Research Center, Urbana, Ill.

Jan. 29-31—44th Annual Meeting, American Meteorological Society, University of California, Los Angeles, Calif.

Jan. 29-31—Solid Propellant Rocket Conference, American Institute of Aeronautics and Astronautics, Palo Alto, Calif.

Feb. 3-7—Fifth Annual Lectures in Aerospace Medicine, USAF School of Aerospace Medicine, Brooks AFB, Tex.

Feb. 3-7—International Conference on Materials "The Impact of Modern Physics on Materials," Sheraton Hotel, Philadelphia, Pa. Sponsor, American Society for Testing and Materials.

Feb. 5-7—Fifth Winter Convention on Military Electronics, Institute of Electrical and Electronics Engineers, Ambassador Hotel, Los Angeles, Calif.

Feb. 13-15—Golden Gate Metals Conference, American Society for Metals, Fairmont Hotel, San Francisco, Calif.

Feb. 19-21—International Solid State Circuits Conference, Institute of Electrical and Electronics Engineers, Sheraton Hotel and University of Pennsylvania, Philadelphia, Pa.

Mar. 2-6—Fifth Conference on Applied Meteorology (Atmospheric Problems of Aerospace Vehicles), Atlantic City, N. J. Sponsors, American Meteorological Society, Federal Aviation Agency.

Mar. 4-6—Symposium on Thermal Radiation of Solids, San Francisco, Calif. Sponsors, National Bureau of Standards, National Aeronautics and Space Administration, USAF Aeronautical Systems Div., University of California at Berkeley.

Mar. 9-10—Aerodynamic Testing Conference, Marriott Twin Bridges Motor Hotel, Washington, D. C. Sponsors, American Institute of Aeronautics and Astronautics, U. S. Navy.

Mar. 23-26—International Convention, Institute of Electrical and Electronics Engineers, Coliseum and New York Hilton, New York, N. Y.

Mar. 25-27—Aerospace Bearing Conference (unclassified), El Tropicano Motor Hotel, San Antonio, Tex. Sponsors, USAF, Southwest Research Institute.

Apr. 1-2—Fifth Symposium on Engineering Aspects of Magnetohydrodynamics, Institute of Electrical and Electronics Engineers, Massachusetts Institute of Technology, Cambridge, Mass.

Apr. 1-3—Fifth Annual Structures and Materials Conference, American Institute of Aeronautics and Astronautics, Riviera Hotel, Palm Springs, Calif.

Apr. 6-8—International Conference on Nonlinear Magnetics (Intermag), Institute of Electrical and Electronics Engineers, Shoreham Hotel, Washington, D. C.

Apr. 13-16—Third International Flight Test Instrumentation Symposium, College of Aeronautics, Cranfield, England.

Apr. 19-25—International Conference & Exhibit on Aerospace Electro Technology, Institute of Electrical and Electronics Engineers, Westward Ho Hotel, Phoenix.

(Continued on page 9)

AEROSPACE CALENDAR

(Continued from page 7)

Apr. 20-22—First Canaveral Space Congress, Ramada Inn, Cocoa Beach, Fla. Sponsor: Canaveral Council of Technical Societies.

Apr. 21-23—Spring Joint Computer Conference, American Federation of Information Processing Societies, Sheraton-Park Hotel, Washington, D.C.

Apr. 22-24—Southwestern Conference & Electronic Show, Institute of Electrical and Electronics Engineers, Dallas Memorial Auditorium, Dallas, Tex.

Apr. 24-May 3—1964 German Air Show, Hanover, West Germany.

Apr. 27-30—Air Transport and Space Meeting and Production Forum, Commodore Hotel, New York, N.Y. Sponsors: Society of Automotive Engineers, American Society of Mechanical Engineers.

Apr. 29-May 2—National Aeronautics and Space Administration's Annual Conference on the Peaceful Uses of Space, Boston.

May 4-6—10th National Aerospace Instrumentation Symposium, Instrument Society of America, Biltmore Hotel, New York, N.Y.

May 4-6—Aerospace Propulsion Meeting, American Institute of Aeronautics and Astronautics, Cleveland, Ohio.

May 4-7—American Astronautical Society's 10th Annual Meeting, "Technical Progress on Lunar Flight Programs", New York Hilton Hotel, New York, N.Y.

May 5-6—Fifth National Symposium on Human Factors in Electronics, Institute of Electrical and Electronics Engineers, San Diego, Calif.

May 11-13—16th Annual National Aerospace Electronics Conference (NAECON), Institute of Electrical and Electronics Engineers, Biltmore Hotel, Dayton, Ohio.

May 11-14—35th Annual Scientific Meeting, Aerospace Medical Assn., Americana Hotel, Miami Beach, Fla.

May 13-15—20th Annual National Forum, American Helicopter Society, Sheraton Park Hotel, Washington, D.C.

May 18-21—23rd Annual National Conference, Society of Aeronautical Weight Engineers, Sheraton-Dallas Hotel, Dallas.

May 19-21—International Symposium on Microwave Theory and Techniques, Institute of Electrical and Electronics Engineers, Idlewild Airport, N.Y.

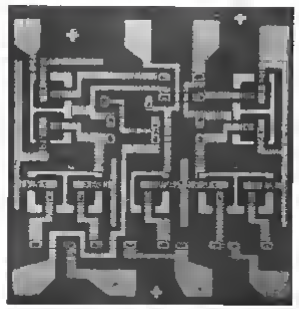
May 25-27—General Aviation Design & Operations Meeting, American Institute of Aeronautics and Astronautics, Wichita.

May 26-28—Second International Forum for Air Cargo, Sheraton-Mt. Royal Hotel, Montreal, Canada. Sponsors: Society of Automotive Engineers, American Institute of Aeronautics and Astronautics, Canadian Aeronautics & Space Institute.

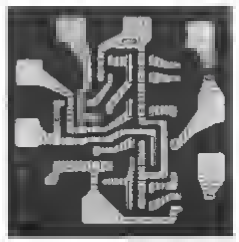
May 31-June 7—International Air Show & International Airport Equipment Exhibition, Caselle Airport, Turin, Italy.

June 2-4—National Telemetering Conference, American Institute of Aeronautics and Astronautics/Institute of Electrical and Electronics Engineers/Instrument Society of America, Biltmore Hotel, Los Angeles, Calif.

June 2-4—National Symposium on Global Communication (GLOBECOM VI), Institute of Electrical and Electronics Engineers, University of Pennsylvania and Sheraton Hotel, Philadelphia, Pa.



The actual size of this complete electrical circuit is 1/16th of an inch square (▪). It contains 9 transistors, 12 resistors and is one of the most advanced products of its kind in the world.



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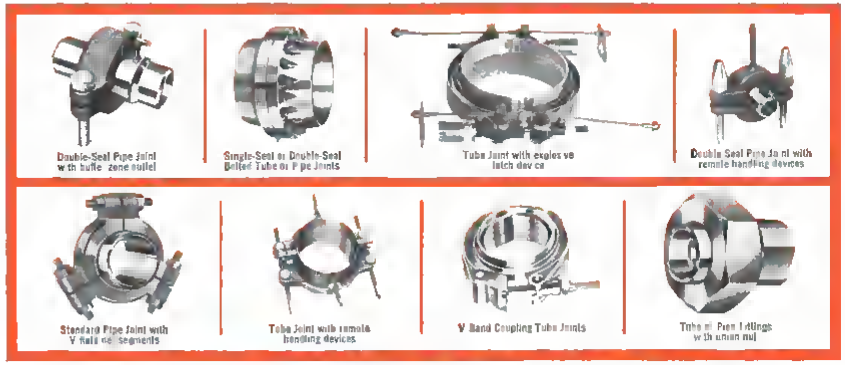

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Charlie Geisewite speaks with authority on aluminum metallurgy

This man's aluminum is going to the moon

ALCOA

(A) Aluminum billets 5½ in. thick, 27 in. wide, 37 ft. long and weighing 5,400 lb. are produced by Alcoa for the Saturn V first-stage booster "Y" rings. They're shown here at Alcoa's Davenport Works awaiting submersion in the ultrasonic testing tank. (B) Fillet after rolling to a 16½-ft. radius. 70 per cent of the metal will be machined away to form a "Y" shape. The piece will then become one third of the Saturn S-1C "Y" ring. (C) Cylindrical portions of fuel and LOX tanks for Saturn V flight boosters are fabricated from 2219 plate furnished by Alcoa 11 ft. wide, 27 ft. long and 2¼ in. thick. The plate is shown after machining being mounted by Boeing technicians on a fixture prior to the age forming process. Boeing eliminated costly labor and tooling processes by forming the plates at the same time the material is aged in an electric air-recirculating furnace.

Some bright morning probably within the next six years, the three man Apollo spacecraft will be launched by the Saturn V rocket into orbit around the moon. Then the two man lunar excursion module will be dispatched for the actual moon landing. A unique high strength aluminum alloy, developed by Alcoa, has been assigned a critical function in getting us there.

This relatively new alloy, designated 2219, has been selected as the major structural material for the Apollo booster because it alone provides the required combination of high strength, light weight, resistance to stress-corrosion cracking, good weldability and a high degree of both uniformity and reliability of weld strength. Nearly 33,000 in. of welding are required for the S-1C, the booster stage of the Saturn/Apollo vehicle which has a diameter of 33 ft. and stands 138 ft. high.

The Boeing Company has a contract with the National Aeronautics and Space Administration-Marshall Space Flight Center, to produce nine S-1C flight boosters and one ground test version. Alcoa will supply approximately 400,000 lb. of 2219 alloy for the fuel and liquid oxygen tanks in each booster. Cylindrical portions of both tanks will be fabricated of plate 11 ft. wide and 26 ft. long. Four sections will be joined by welding to form a hoop more than 100 ft. in circumference. Sidewall for the 44-ft. long fuel tank will be made by stacking two hoops and welding them together. Four such hoops will form the walls of the 64 ft. long liquid oxygen tank. Two domed ends for each tank will be fabricated by using 2219 plate sections.

Of particular interest are the "Y" rings, an integral part of the fuel tank and outer structure. For these, Alcoa supplies 2219 aluminum alloy in the form of 5,400-lb. billets.

Both plate and billets must be ultrasonically clean and delivered in Class A ultrasonic condition. The man responsible for the critical quality control that makes this possible in these unusually large sizes is C. F. Geisewite, Chief Metallurgist at Alcoa's Davenport, Iowa Works, where Alcoa® Alloy 2219 for Saturn is rolled. Charlie Geisewite is a veteran of 35 years with Alcoa—and a veteran in working with customers in the aerospace industry. He's worked in the metallurgy departments of practically all of our plants on both development and quality control problems, has been associated with some of the pioneering achievements in the history of flight.

When we opened the Davenport plant in 1948—from the beginning it has been the world's largest aluminum rolling mill—Charlie was the obvious choice to head up its metallurgy. Since then he has trained dozens of young men who have made a name for themselves in advancing the art and now serve Alcoa customers throughout the world.

When you have a problem that a knowledgeable use of metals might solve, it pays to deal with the supplier offering the greatest depth in experience, research and technical assistance. In the case of aluminum, that supplier is Alcoa. Just call the local Alcoa sales office, your liaison with technical people like Charlie Geisewite. Or write Aluminum Company of America, 1868-M Alcoa Building, Pittsburgh, Pa., 15219.

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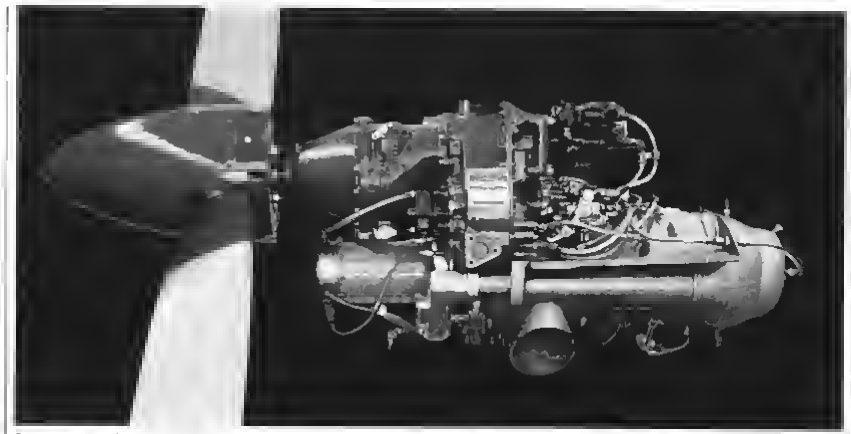
ALCOA

The turboprop T63 is ready for flight



Turboprop version of the Allison T63 engine. In its turboshaft configuration, the T63 is powering Light Observation Helicopters (LOH) as they prepare for Army tests.

It's passed the 50-hour Preliminary Flight Rating Test . . . can very quickly complete its 150-hour test for Army acceptance and Federal Aviation Agency certification.

How does it differ from the turbo*shaft* T63 that powers the Army's Light Observation Helicopter? A reduction gear is added to provide a suitable shaft speed for a flange-mounted propeller.

And both these engines have the built-in reliability that's standard equipment with every Allison turbine engine. We've built over 35,000 turbine engines . . . and they've flown more than 30,000,000 hours. Today, whether serving our armed forces or the world's airlines, they're setting new records for reliability in many kinds of service.

Born to be a turboprop

The turboprop T63 is so far along in its development because it was designed to convert easily from turboshaft to turboprop. And, of course, both versions of the T63 have the same attributes . . . simplicity, compactness, ease of maintenance and of overhaul, and light weight.

The T63 engine is less than 4 inches longer than its turbo-shaft brother . . . and the gearbox adds only 22 pounds to the engine's weight.

The engine can power both fixed- and tilt-wing aircraft in its turboprop version . . . in addition to powering the LOH in its turboshaft configuration. Obviously, the use of identical engines would have many military advantages.

Turboprop T63 can power planes such as these shown here and other craft.

Logistics simplified

Parts supply problems would be minimized . . . mechanics' training would be simplified . . . so would pilot familiarization time.

Parts inventories would also be reduced because many parts would be common to both engines.

Today the turboshaft version of the T63—the T63-A-5—is powering the Bell OH4A, Hiller OH5A and Hughes OH6A as they prepare for Army LOH airframe evaluation and flight tests. Its operating experience to date proves it's one of the simplest, and most easily maintained engines the Army has.

If you'd like more information about the T63—in either its turboshaft or turboprop configurations—we'd be glad to send it to you. Just write Allison Division of General Motors, Box 894XX, Indianapolis, Indiana 46206.

Turboshaft version of the T63 which is powering Light Observation Helicopters.

ON TARGET WITH LOH POWER

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CONTENTS

COVER Army Lockheed XV-4A Hummingbird VTOL hovers just after lift off from the apron in front of the Lockheed-Georgia hangar. Powered by two Pratt & Whitney JT12 turbojet engines, the aircraft achieves vertical lift through a system that mixes high velocity exhaust gases with free air. Note visible heat waves beneath the aircraft, distorting shapes of people in the hangar doorway. For additional photos of the XV-4A see pp. 82-83.

PICTURE CREDITS
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Another Step Forward

The national space program has taken a significant step forward with President Lyndon B. Johnson's decision to develop a military orbital space station. Politically, it represents a reversal of Defense Secretary McNamara's long held position that no expansion of military space capability was necessary, and it is a shrewd maneuver to vitiate Republican criticism of the Democratic Administration's space policy before the 1964 election campaign. Technically, it will fill an important gap in the currently planned national space program and broaden the engineering and industrial foundations of this effort.

The decision to entrust development of a manned orbital space station to the Air Force was precipitated by some difficult choices that had to be made in the Fiscal 1965 defense budget before it could be hammered into final form. Cancellation of the USAF Dyna Soar program offers a considerable reduction in the Fiscal 1965 budget, and the decision to proceed with the manned orbital laboratory will not require substantial funding before Fiscal 1966-67. Eventually, the orbital laboratory program could far surpass the expenditures required for Dyna Soar. But that fiscal day of reckoning can now be postponed to a less politically sensitive budget than the Fiscal 1965 document on which President Johnson must base his economy record for the campaign next fall.

Significant Building Block

The initial manned orbital laboratory program—as now planned—is not a particularly ambitious advance in the state of the art. It is based primarily on space system components already under development for other programs. Technically, it is little more than an extension of the operational capabilities already planned for Gemini (see p. 30).

Nevertheless, it is an extremely significant building block in the over-all structure of space technology. It will lift the bitter debate over man's eventual capabilities in space operations out of its current repetitious conflict of theories into a factual realm in which solid answers can be substituted. The manned orbital laboratory will provide an ideal vehicle to explore space out to the Van Allen belts with a thoroughness not possible with unmanned satellites and probes. It will also provide a testing and proving ground for all of the components and subsystems for future space vehicles in a genuine space environment. Lack of this capability has been a serious handicap to achieving acceptable reliability for operational space systems.

There are some experts who maintained that the manned orbital laboratory should have been the next step after Mercury and before Apollo. With the advantage of hindsight, it is difficult now to challenge their thesis. But the timing of the orbital laboratory in relation to Apollo is no longer germane. It is better late than never. And it is absolutely vital to develop the full capability of second-generation space vehicles and solve the many riddles posed by the next decade of space exploration.

A Sound Decision

The manned orbital laboratory will continue to depend on the ballistic-type re-entry vehicle with minimal maneuverability. The development of truly maneuverable space and re-entry vehicles will continue on a more modest scale with the ASSET program of unmanned research vehicles substituted for the manned Dyna Soar. Although its eventual military value may not be as readily apparent as the orbiting laboratory, this important line of development should not be snipped short with some glib budgetary mumbo-jumbo.

We think President Johnson has made a sound decision in establishing the manned orbital space laboratory as a program and assigning it to the Air Force for management. NASA has its technical resources occupied to capacity in bringing the Apollo program to fruition, and Congress would never approve a further swelling of this agency's budget for the space station mission. By recognizing that the answers to future of military space must be founded on experimental fact rather than computerized philosophy, President Johnson brings a badly needed realism to focus on this vital problem. Mingled with the general approval of this decision, however, is some misgiving over the fact that the problem of organizing a truly national space program has not been solved. There is no significant military input, except in support roles, in the Mercury, Gemini or Apollo programs. And from what Mr. McNamara pointedly emphasized in his explanation of the orbital laboratory management, there will be no significant NASA input into this one. This dovetailing of resources and requirements into an effort that provides the vital answers to both civil and military space problems no doubt will receive further attention from President Johnson as he strives for maximum results with maximum efficiency.

—Robert Hotz

WHO'S WHERE

In the Front Office

Dr. Don R. Berlin, a vice president, Curtiss-Wright Corp., Wood-Ridge, N.J.

William L. Cook, president and general manager, Borg-Warner Controls Div., Borg-Warner Corp., Santa Ana, Calif., succeeding **Donald R. Spotz,** who continues as president, Pesco Products Div., Bedford, Ohio.

Joseph W. Barron, vice president-administration and planning, Link Div., General Precision, Inc.'s Simulation and Control Group, Binghamton, N.Y., and **Robert J. Campbell,** vice president-marketing. Also, **Dr. John M. Hunt,** a director of General Precision. Dr. Hunt is senior vice president and technical director of the Simulation and Control Group.

Murray Weingarten, vice president-operations, Bendix Field Engineering Corp., Owings Mills, Md., a subsidiary of The Bendix Corp.

Robert W. Ekis, assistant to the vice president of engineering, Beech Aircraft Corp., Wichita, Kan.

Stanley R. Schoen, administrative assistant to the president, Lear Siegler Service, Inc., Santa Monica, Calif., he continues as assistant secretary of Lear Siegler, Inc.

Honors and Elections

Dr. E. O. Hartig has been elected a Fellow of the Institute of Electrical and Electronics Engineers, in recognition of his "contributions in the field of coherent high resolution radar." Dr. Hartig is manager of electronics engineering, Goodyear Aerospace Arizona Div. Also, **Richard F. Gifford,** general manager of General Electric Co.'s Communication Products Dept., elected a Fellow of the IEEE for "leadership in the field of communication techniques and practices."

Changes

Robert R. Hewitt, director economic planning, Continental Air Lines.

Dr. Amnon Yariv, manager of the new Electro-Optical Devices Research and Development Dept., Watkins-Johnson Co., Palo Alto, Calif.

Kenneth Jormolow, director, Martin Co.'s Research Institute for Advanced Studies (RIAS), Baltimore, Md.

Raymond T. Moore, chief, Measurements Automation Section, Data Processing Systems Div., National Bureau of Standards, U.S. Department of Commerce, Washington, D.C.

J.A. Grace, assistant to the managing director, Smiths Aviation Div., S. Smith & Sons (England) Ltd.

Claude Peyrot, assistant to general manager of North, Central American and Caribbean Div. of Air France. Also, **Howard Weisser,** wages, salaries and benefits manager for the division.

Col. Lloyd R. Hoyes, chief, Behavioral Sciences Laboratory, Aerospace Medical Research Laboratories, Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio.

Frances R. Flood, marketing manager, Semiconductor Div., Raytheon Company, Mountain View, Calif.

INDUSTRY OBSERVER

► New generation of ballistic missile re-entry systems, broadly referred to as Mark Z, is being investigated at Aerospace Corp. and Air Force's Ballistic Systems Div. Entirely new systems and approaches not now contemplated in any of USAF's advanced re-entry programs are to be explored.

► Johns Hopkins University's Applied Physics Laboratory has determined that the Transit satellite launched Sept. 28 is oriented upside down (AW Nov. 25, p. 34) because the plastic material in the gravity gradient stabilization housing sublimated early, causing the spring that releases the boom to deploy prematurely. To prevent a re-occurrence, the next Transit may have antennas on both faces of the payload.

► Possible delay in the availability of Atlantic Research Corp. Athena four-stage launch vehicles for firing re-entry systems from Green River, Utah, to impact at White Sands, N.M., may cause USAF Ballistic Systems Div. to substitute another boost vehicle—possibly the Chrysler Redstone—for the first six launches. Aim of Athena firings is to provide trajectory dynamics on re-entry systems and penetration aids (AW Sept. 2, p. 26).

► Due to the tight Gemini and Apollo flight test schedule during the 1965-1966 period, NASA will attempt to minimize duplication of spacecraft tests by contractors and the agency. Spacecraft acceptance tests and checkouts, and individual systems tests, will be conducted at the manufacturers' plants, rather than at the Manned Spacecraft Center's Pre-Flight Operations Div. at the Kennedy Space Center. The division will not re-run these tests, but will conduct integrated systems tests and others that involve firing of thrusters or loading fuel.

► Flight readiness firing test of the Martin Titan 2 Gemini launch vehicle has been eliminated because NASA feels it can obtain sufficient pre-flight information through the sequential compatibility firing. Sequential test is run with the stages side by side. Flight readiness firing would have been run with the vehicle fully assembled.

► United Aircraft Corp.'s Hamilton Standard Div. will build a full-scale installation mockup of a strap-on propulsive system that might be used by Apollo astronauts in space and on the moon. Hamilton Standard, prime contractor on the Apollo spacesuit and builder of the Apollo life support back-pack (AW Oct. 28, p. 48), is developing the propulsion pack design under a six-month engineering study financed by a recent $68,717 NASA contract.

► Lockheed Propulsion Co. claims exceptionally even burning and a high burning rate for nitro-plastisol solid propellant grain, using an aluminum honeycomb form embedded in the propellant. Company says the pressure-time trace for this grain is virtually level.

► NASA intends to continue contracting for services, despite criticism from the Budget Bureau and the U.S. comptroller general. The agency's position is that it cannot recruit or maintain highly specialized engineering groups to meet constantly changing requirements. NASA hopes to devise a contracting policy that meets the objections, rather than resort to hiring more personnel.

► Renaming three nose cones built by Chrysler Corp. for the Air Force's advanced ballistic re-entry systems (ABRES) program may be flown on a secondary-objective basis on Atlas and Titan ICBMs launched from Vandenberg AFB, Calif., as testbeds for warhead arming and fuzing systems. Three of the six nose cones Chrysler built for ABRES were flown.

► Feeling in industry and military circles is that top Air Force officials are unenthusiastic about advanced intercontinental ballistic missile ideas because of a desire to focus Defense Dept. interest on new aircraft to meet future strategic operational requirements.

Washington Roundup

Defense Economy Drive

Defense Secretary Robert S. McNamara swung his economy ax harder than ever before last week and chopped off enough military operations to keep Congress in a high state of agitation through much of 1964.

He canceled the USAF-Boeing X-20 (Dyna-Soar) program and, as consolation prizes, gave the Air Force management of a space station and an expanded ASSET glider project (see p. 30), announced the eventual closing of 33 defense installations, 26 in the U.S. and seven overseas, indicated several naval shipyards may get the ax later, and readied other plans to reduce Defense Dept. personnel—especially those serving overseas in a supporting rather than combat capacity.

Immediate objective of this economy campaign is to cut Fiscal 1964 spending about $1.5 billion. At a hastily called press conference last week, McNamara said his money-saving recommendations had been approved by President Kennedy before his assassination. President Johnson also approved the steps after taking office and now can point to them as making good on his promise to show "utmost thrift and frugality."

Grand Strategy

Long-range objective may well be to smooth the way for a tax cut next year by showing key conservatives in Congress that the executive branch is really serious about holding down its own expenditures. But other political consequences of this course include the prospect of McNamara running through a bruising congressional gauntlet next year when one-third of the Senate and the entire House is up for re-election.

Already there are efforts under way to soften the impact of these economy moves. Sens. Henry M. Jackson and Warren G. Magnuson, Democrats from Boeing's home state of Washington, obtained McNamara's pledge that the Defense Dept. would study a phase-out of the Dyna-Soar program rather than the originally announced abrupt Dec. 15 cut-off. Some 4,200 Boeing employes stand to lose their jobs. The senators also are telling their constituents that Boeing has a good chance of getting a role in the manned orbiting laboratory—estimating it as a $400- to $500-million program. They figure the first phase will cost between $50 million and $70 million. Sens. Jackson and Magnuson also said Defense Dept. "is investigating the possibility" of giving ASSET work to Boeing.

Softening Moves

Another softener is shutting the military bases in stages, with 25% of the shutdowns scheduled in Fiscal 1964 and 60% in Fiscal 1965. All 33 installations will be closed by July 1, 1966, under McNamara's present timetable. Among those slated to be closed is Stead AFB in Nevada. Mira Loma Air Force Station in Ontario, Calif., and the Naval Air Facility at Litchfield Park, Ariz. The Rome, N.Y., Air Materiel Area at Griffiss AFB will be moved to an undisclosed new location, while the Army's Miller Field on Staten Island will be moved to Lakehurst, N.J., Naval Air Station. McNamara said the closings will save $100 million when completed, and reduce the Defense Dept. payroll by 7,800 military and 8,500 civilian personnel. McNamara estimates another $336 million may be netted from selling the 271,500 acres of land and 54 commercial facilities released by the military.

The political furor resulting from the base closings will be followed in Congress by hearings on the strategic implications of the X-20 cancellation and the coming death of the North American B-70 (see p. 30). Man to watch in this coming debate is Sen. Richard B. Russell of Georgia, chairman of the Senate committee which authorizes Defense Dept. money and also head of the subcommittee that recommends how much to appropriate.

MOL Competitors

Air Force source evaluation board has recommended that Boeing, Douglas and Lockheed receive contracts to study the manned orbiting laboratory (see pp. 30, 32). Original specifications called for analysis of a number of configurations, but the winners will be told to concentrate on Titan 3C-canister-Gemini systems during contract negotiations.

Defense Dept.'s request for between $49 billion and $50 billion in new money for Fiscal 1965 will include funding for providing a military communication satellite system in two years. System would consist of 24 to 27 satellites in medium-altitude random orbits. Thor or Atlas Agena combinations would carry seven satellites in each payload.

Joint Chiefs Deputy

Pentagon plan to name Army Maj. Gen. Andrew J. Goodpaster to the newly created position of assistant to the chairman of the Joint Chiefs of Staff has aroused fears in Congress that this may be the first step toward subordinating the service chiefs to an over-all, single chief of the armed services. McNamara last week told the Senate Armed Services Committee that it was "disgraceful" that a secret discussion of the joint chiefs about the new position was reported in the press.

The reason military space leaders chose the name manned orbital laboratory was their fear that the word "station" connoted operational, rather than research use.

—Washington Staff

Air Force Given Space Laboratory Mission

X-20 canceled as Johnson approves first military manned orbital effort; program has tight schedule.

By Larry Booda

Washington—Air Force won its seven-year struggle for a manned space flight role last week when it was assigned management responsibility for the national space station program. Decision to give the program to Air Force was made by President Johnson, and it establishes the framework for this nation's next billion-dollar space effort.

Assignment of the space station task to Air Force had been predicted by AVIATION WEEK & SPACE TECHNOLOGY because USAF considered the station its top-priority space program, and it was a low-keyed effort in National Aeronautics and Space Administration (July 22, p. 214).

As described by Defense Secretary Robert S. McNamara, the system, called MOL for manned orbiting laboratory, will consist largely of hardware already under development (see box, p. 31). Two-man crew will be launched in a NASA-McDonnell Gemini capsule, called Gemini X, by a Martin Titan 3C launch vehicle.

Between the capsule and the launch vehicle will be a cylindrical laboratory, and crewmen will transfer to the laboratory through a trap door in the capsule heat shield. They will experiment for two to four weeks, return to the Gemini capsule, separate from the laboratory and re-enter the atmosphere for a landing. No attempt will be made to recover the laboratory.

In what is interpreted as a trade-off with Air Force, McNamara canceled the X-20 (Dyna-Soar) boost-glide re-entry vehicle program, effective Dec. 15 because, he said, its objectives are too limited. In its place an expanded ASSET (aerothermodynamic-elastic structural systems test) designed to test a variety of re-entry vehicle shapes and materials will be conducted concurrently with development firings of the Titan 3 booster which will be used in the MOL program.

X-20's future has been in serious doubt since early this year (AW Feb. 25, p. 26). While McNamara has been cool to any military manned space flight plans, he centered most of his antagonism on X-20 during Fiscal 1964 congressional hearings.

Industry study contracts for the USAF laboratory system will soon be let by the Air Force (see p. 32). Contracts will be monitored by Space Systems Div. team in Los Angeles headed by Col. W. D. Brady, chief of advanced planning and acting chief of advanced development.

McNamara claims a savings of $100 million in 18 months by canceling X-20 in favor of MOL and ASSET. MOL is estimated to cost $1 billion, about the same as the X-20 in its one-man configuration.

Final arguments for the program were presented to McNamara the Friday preceding the Dec. 11 announcement. Until the end, the Air Force argued to keep the X-20 program, maintaining that it was too far along to cancel.

Timetable for the MOL program calls for the first unmanned capsule launch in the first half of 1966. After several unmanned shots, the first manned launch is scheduled late in 1966. Plan now is to test capsules with both Titan 2 (LV-4) and Titan 3 (SLV-5) launches. First unmanned launch of laboratory and capsule with Titan 3 is scheduled late in 1967, and the first manned flight target date early in 1968. The launch schedule approximates that of the NASA Apollo program.

Major features of MOL are:

- **Laboratory**—Cylinder about 25 ft. long and 10 ft. dia., the same diameter as the Titan 3 cone. It will have a life support system able to sustain more than the two-man Gemini X crew. Laboratory will weigh about 15,000 lb.
- **Capsule**—A slightly modified Gemini capsule weighing 7,000 lb. Since it will be attached to the canister during the orbital period, it will be able to draw power from it. Thus the fuel cell which furnishes electrical power and drinking water will not have to be as large as the NASA Gemini fuel cell.

The life support system will not operate beyond boost, transfer, return, re-entry and landing periods compared with periods up to 14 days and a reserve of 16 days in the NASA Gemini system. The capsule's hydrazine attitude control system also will be smaller because maneuvers in orbit will be made by laboratory systems. The capsule will be faired into the transtage of the Titan 3 booster.

- **Booster**—Titan 3C, designed to be a multi-purpose vehicle, consists of the Titan 2 two-stage core, topped by a transtage. All core stages will burn storable fuels. Two 120-in. solid-propellant rockets are strapped to the core. First launch of Titan 3A—the core only—is scheduled for December, 1964, while the core plus the solid-propellant rockets will be launched in June, 1965.

In operation the crew members take off their space suits and move freely inside the laboratory. They will practice a daily routine and perform whatever experiments they have been assigned. Air Force says they will have no mission other than discovering what tasks can be accomplished in space.

Air Force Pleads for XB-70 Funds

Washington—Air Force was making a last-ditch plea to Defense Dept. late last week to reconsider its request for $120 million during the next two fiscal years to complete construction and flight test of its three North American XB-70 aircraft. Funds for the XB-70 were not in the draft budget circulated in the Pentagon last week and if this decision holds it is questionable whether USAF can continue the program through flight test.

Air Force asked for $80 million in its Fiscal 1965 budget for the aircraft, and the projected Fiscal 1966 request is $40 million. Through last October $1.287 billion has been obligated for the project, but during the past 18 months the program has been operating on carry-over funds because Defense Dept. has refused to release XB-70 money authorized by Congress (AW May 13, p. 25).

Rollout of the first aircraft, now planned for next February, is 15 months behind the original schedule (AW Aug. 12, p. 85). First flight, from Palmdale Airport to Edwards AFB, is expected next April. Several weeks of ground testing at Palmdale will precede the first flight.

Air Force traces the delays to difficulties in achieving nitrogen-type seals in fuel-carrying structures, and in attaining three-dimensional welds that are 52 ft. long. Right wing fuel tanks have been sealed, and North American is matching this wing to the fuselage. Welding will begin later this month.

Problems in matching wing and fuselage have been caused when the wings warp after they are heated to temperatures of 300-350F to cure the vitron elastomer tank sealant. Mismatches occurred between the wings and wing stubs and a number of attachment points have been relocated for alignment.

MANNED ORRITAL LABORATORY assigned last week to the Air Force for management will consist of a Titan 3 booster, which in turn is made up of a Titan 2 core coupled to a transtage and two strap-on 120 in.-dia. solid propellant rockets; a multi-man laboratory canister and a Gemini X capsule. The two-man crew will ride into orbit and return to earth in the capsule after conducting experiments from two to four weeks in the laboratory. In the drawing the area between the arrows indicates location of the laboratory.

Any participation by NASA, McNamara said, will be a decision that will be made by Air Force. He said the MOL program is "exactly the reverse" of NASA's Gemini, and that any NASA tests will be done under USAF management, with NASA paying for them.

As originally planned, the ASSET program consisted of six glider flights launched by Thor or modified Thor-Delta vehicles. All six would have had the same shape and be made of the same materials (AW Mar. 18, p. 34).

Air Force now plans to launch a variety of shapes and different materials as part of Titan 3 development launches. Shapes resemble the X-20, without the blunt rear section.

McNamara used the expanded ASSET program in his argument for canceling the X-20, saying that studies of re-entry techniques and orbital operations could be made at a much lower cost in unmanned vehicles. He insists that the one-man X-20 configuration and its static shape and materials combination does not justify the cost.

About $400 million has already been spent on the X-20. It will take $80 million of the $125.4 million appropriated for Fiscal 1964 to terminate the program. Air Force planned to request $146 million for X-20 in Fiscal 1965. A total of $860 million plus $150 million in over-runs had been forecast for the one-man X-20. McNamara said for the Phase 2 five-man version he said it is not possible to determine the cost accurately.

Boeing Co., the X-20 prime contractor, had not received Air Force termination instructions as of late last week but estimated that about 5,000 employes would be directly affected. Of that number, 4,000 are employed in the Aerospace Div. The X-20 program called for 12 launches. The first would have been one orbit for a duration of 90 min., building up to three orbits by the 12th.

Some congressmen did not like the X-20 cancellation, but there is little chance that key Democratic committee chairmen will press their committees to protest it.

Chairman George H. Mahon (D.-Tex.) of the House Defense Appropriations Subcommittee—the unit that will be the first to appropriate money for the Defense Dept. next year—sounded the theme in Congress by declaring he had "some misgivings" but planned no protest of the Dyna-Soar decision. He said he consulted with McNamara about the action before it was announced last week.

Sens. Henry M. Jackson and Warren G. Magnuson, Democrats from Boeing's home state of Washington, were upset about the cancellation and its political consequences but see no way to remedy the situation.

Chairman George P. Miller (D.-Calif.) of the House Science and Astronautics Committee saw a side benefit in the Dyna-Soar decision—pushing the Air Force and National Aeronautics and Space Administration closer together, because the space station will be used by both agencies.

He said, "I was never strong" for X-20 because of its limited capability. He characterized the basis for the Dyna-Soar cancellation as "a more realistic look at what must be done to obtain spatial control for both our civilian and military space needs."

Laboratory Competition

Washington—Air Force has not decided whether it will select an aerospace firm as prime systems contractor for the manned orbiting laboratory or manage the system itself. As a result, the only certain major industry competitions in the program will be for the laboratory canister and its subsystems.

Titan 3, the MOL launch vehicle already is under development with Martin Co. as prime contractor and United Technology Center and Aerojet as engine contractors. McDonnell Aircraft Corp. is manufacturing Gemini spacecraft for NASA and will keep its production line open for USAF's Gemini X. NASA has ordered 12 Gemini flight capsules.

MOL Studies to Include Army, Navy Tasks

Industry studies of the USAF Systems Command manned orbiting laboratory will be oriented toward considerations of Navy and Army mission requirements as well as those of the Air Force. Although Defense Secretary Robert S. McNamara declined to discuss specific missions when he announced the space station program (see p. 30), a wide range of potential military uses will be analyzed in the studies.

The studies will establish how personnel can participate efficiently in military space station missions and how this capability can complement normal scientific-laboratory functions in the evolution of a national orbital space station program (AW Dec. 9, p. 37).

Any U.S. space station effort will initially, at least, be a compromise configuration blending scientific as well as military requirements. This will be necessary because of the cost involved for the station, its diverse subsystem capabilities, launch requirements, supporting spacecraft and maintenance and repair needs.

The orbital station pre-program definition studies, which will be performed as parallel investigations by three contractors, probably will be the most intensive effort ever crowded into a four-month study period. Some of the industry reports for specific task categories will have to be submitted within one month after contract approval.

Program 287

Military missions for the orbital space station—designated Program 287—are expected to fall into these broad categories in the operational configuration:

• **Surveillance.** This function would be performed on a continuous basis from the space station. In addition to general scanning to observe any activity or phenomena on earth which might have military significance, particular emphasis would be placed on detecting booster launches from potentially hostile military installations, as well as launches from pads normally used for boosting scientific payloads into orbit.

This would be coupled with a capability for tracking the launched vehicle continuously from lift-off to progression along its normal trajectory or deviations—or into orbit.

Detection and tracking data would be relayed to earth stations to alert an immediate-response capability. If there were no emergency, optical sensor data probably would be processed rapidly and returned to earth in a capsule or some form of space vehicle. The data vehicle would perform a controlled letdown in areas convenient for detailed examination of the information. Infrared scanning techniques perfected with the missile defense alarm system (Midas) satellite experiments and optical sensing techniques developed in the Samos satellite program would be utilized for the surveillance function of the orbital space station. Other sensors which might be employed are ultraviolet and radar types.

• **Ocean surveillance.** Strategic importance of ocean areas probably will require that they be given special surveillance from orbital space stations. Prime task would be detection and tracking of hostile submarines, to maintain a running log of potential missile launch threats. Detection of hostile submarines will require special attention, because of their ability to launch missiles in concealment from great distances off shore.

This mode of surveillance may require development of special sensors to detect and track submarines which have not surfaced. These sensors might be applied to detection of the wake for considerable periods after the sub has passed, whether surfaced or submerged.

The space station also could function as a navigation aid for U.S. submarines to establish a precise position and ensure a high degree of missile targeting accuracy when the vessels are out of sight of landmarks. This would be an important factor with the lower-yield warheads which submarines are likely to launch, because small gains in accuracy can offset the effects of substantial increases in yield.

• **Reconnaissance.** This function probably would be tied to at least three operational regimes. In a cold war situation, the space station would perform a general role and monitor a broad array of ground sites pre-selected for the scanning operation. Choice of these sites would be altered from time to time to eliminate some and include others.

In addition, the space station would, on command, select a specific ground site or group of sites for viewing on a priority basis in emergencies. Relatively invulnerable compared with reconnaissance aircraft, the station could take photographs before, during and after passing over the target area, process these pictures and radio them to headquarters or return them by capsule or space vehicle if time permits. During a single day, 12-18 different series of pictures might be taken, depending on the station's orbital altitude. The altitude, in turn, affects the orbital period. If the area to be reconnoitered were extensive, the orbital inclination of the space station would permit it, within a few days, to cover the entire area.

In the event of general hostilities, the space station could serve as a scanning platform to assess post-attack damage in hostile territory and relay this intelligence to headquarters to aid in deciding further strategy.

Substantially the same array of sensors used for the surveillance function would be used for the reconnaissance task, with the possible addition of special electromagnetic sensing equipment for special detection capability.

Inspecting Strangers

• **Inspection and destruction.** These mission capabilities probably would be performed by the space station itself if it were a small configuration or by spacecraft associated with it. Inspection might be attempted in two modes. A rendezvous mode would involve maneuvering to attain a relatively close position to the suspect spacecraft in its orbit and maintaining this proximity (perhaps 50-100 ft.) for a sufficient length of time—maybe up to three or four orbits—to perform the inspection mission. The second mode would not require the ability to maintain this close proximity with the suspect spacecraft, but would involve a fly-by in the orbital or near orbital plane for a cursory inspection.

The rendezvous vehicle would incorporate devices to kill the suspect spacecraft—or it might use only negation devices, such as electronic countermeasures, if it were desired only to disable or render the suspect spacecraft inoperative. The fly-by vehicle at best would only incorporate a negation capability because of the limited time it would be within effective range of the suspect spacecraft.

Sensors likely to be employed during the rendezvous and fly-by operations are radar and infrared types.

Weapon Effectiveness

• **Weapon delivery.** Effectiveness of delivering weapons from an orbital platform is a point of debate in military and industry circles. However, a military space station projected to be operational in the early 1970s almost certainly would provide for a weapon delivery capability. Weapons might be of two types—orbit-to-ground and orbit-to-space. Either type might be deemed offensive or defensive weapons. How they would be used would depend on the specific situation, but the primary reliance would be on defense, since the military space station would have to incorporate self-protection measures. One of the key uses might be anti-ICBM action. A space station might be effective to launch a weapon for interception during any phase of an ICBM trajectory.

Industry sources feel that the space station would be a feasible platform with which to establish capabilities for lasers as weapons against hostile satellites and ICBMs.

• **Command and control.** This mission might evolve as a prime communication headquarters in space. This would be an extension of the concept of using an aircraft with the benefit of decreased vulnerability. If the space station were not a prime command and control center, it probably would be given an alternate status for this function.

Command and control functions in space vehicles had been considered early in the USAF space program by Space Systems Div. planners, as an extension of capabilities for the Saint (satellite intercept) satellite, with a 30,000-naut.-mi. altitude capability.

• **Space logistics, maintenance and rescue.** This mission, generally designated by the acronym Slomar, incorporates the operational support task of performing services for ferry vehicles associated with the spacecraft. Conceivably, this function could be extended to service miscellaneous spacecraft in orbit, but it probably would require use of a space truck as an auxiliary vehicle for the space station.

Because of the cost of the station and the expense associated with putting it in orbit, operational life will have to be at least two years, more probably five. Initially, operational altitude of the military space station may be limited to about 500 naut. mi. but later versions may be deployed at altitudes of about 5,000 naut. mi.

In its specification, Systems Command asked for analysis of Titan 2, Titan 3C, Saturn 1 and Saturn 1B launch vehicles and Gemini, Apollo and Dyna-Soar (X-20) ferries. With the cancellation of the X-20 as of Dec. 15, and development of concepts that have become more specific, the Titan 3 laboratory-Gemini configuration will be used initially. Other vehicles and ferries will be studied as possible advanced programs.

In analyzing military missions for the space station and how they might be performed, studies which previously have been performed for the Air Force probably will be considered. These studies likely will include:

• **SR-79822,** advanced earth satellite weapon system (AW Apr. 10, 1961, p. 26). This study anticipated an operational mode in orbits above 10,000 naut. mi.

• **SR-79821,** earth satellite weapon system (AW Apr. 10, 1961, p. 26). Operations considered in this study were for altitudes below 1,000 naut. mi.

• **SR-79814,** space logistics, maintenance and rescue (AW Jan. 2, 1961, p. 43). This Slomar concept was studied extensively by many industry contractors in basic efforts, funded and unfunded, but no follow-on studies resulted.

• **SR-17527,** military test space station (AW July 22, p. 214). Studies of this concept were conducted by several companies for Air Force in 1960-61.

• **SR-181,** strategic orbital system (AW Apr. 23, 1962, p. 19). This study was oriented toward tradeoffs of manned vs. unmanned systems.

• **SR-178,** global surveillance system studies (AW Feb. 27, 1961, p. 22). These studies anticipated maneuverable manned satellites with substantially improved capability over current space surveillance systems.

The general approach to the space station study is expected to be divided into four tasks. The basic task will be to spell out the technical requirements to satisfy military missions and to indicate how a station can promote success of these missions.

Another task will be to analyze station capability as a platform for conducting tests to evaluate crew performance for military missions in space. This would involve consideration of capabilities associated with operations inside and outside the space station.

A third task will call for analyzing the extent that the test requirements will affect space station system operation, so that reasonable tradeoffs may be made. Systems and subsystems to be analyzed under this task must encompass the complete spectrum of installations required for station operation. These installations would include those types which have been analyzed in previous space station studies and ones now being conducted for National Aeronautics and Space Administration.

The final task will require establishment of a preliminary station configuration capable of conducting tests to evaluate crew performance for the various military missions.

Three-Place Helicopter Uses New Engine

New Model 300 three-place helicopter introduced by Hughes Aircraft Div. is powered by a new 4-cylinder Lycoming fuel injection engine, Model HIO 360A1A, rated at 180 hp. The new aircraft is a second-generation model of the company's 269A with interior redesigned to accommodate a third seat. Aluminum rotor blades are 1.75 in. longer and the leading edge is hard-anodized, eliminating a stainless steel leading edge strip. Design gross weight has been increased 70 lb. to 1670 lb.

NASA Fund Cuts to Slow Saturn 5, LEM

By Alfred P. Alibrando

Washington—Immediate effect of the funding crisis precipitated by the cut of $620 million in the National Aeronautics and Space Administration's Fiscal 1964 budget—from $5.72 billion to $5.1 billion—will be a slow-down in the development of the Saturn 5 rocket and Apollo Lunar Excursion Module.

NASA directed the delays in telegrams to 11 prime or top-tier subcontractors ordering a freeze on hiring new employes. The freeze, most drastic cutback since the agency was formed five years ago, brought the space program's financial plight into new focus with these developments:

- **Prospects for a supplemental** Fiscal 1964 appropriation of $200 $250 million brightened.
- **Maintaining Apollo's scheduled** goal of landing men on the moon by 1970, and other current NASA programs, will require a minimum of $11 billion in Fiscal 1964 and 1965, Administrator James E. Webb advised President Johnson.
- **Freeze order convinced** some skeptics and opponents of the space program in Congress that NASA was telling the truth when it said it needed an absolute minimum of $5.35 billion in Fiscal 1964 to carry out the presently scheduled program. Congress is expected to be more liberal with NASA next year in view of this year's experience.

Freeze order telegrams were sent Dec. 5 to Boeing, General Electric, Douglas, Massachusetts Institute of Technology, Kollsman, Raythcon, AC Spark Plug, Chrysler, North American, Rocketdyne and Grumman. NASA advised:

"Funds approved in congressional action on the NASA budget for the Fiscal Year 1964 will not support previously planned employment. While our assessment is continuing, you are directed to freeze manpower levels as of this date. You are further directed not to replace personnel ..."

AVIATION WEEK & SPACE TECHNOLOGY learned that these 11 and their first-tier subcontractors would have hired 8,000 new employes between Dec. 5 and Jan. 1.

Reprograming actions involve a total of $250 million, which is the difference between what Congress authorized ($5.35 billion) and appropriated ($5.1 billion) (AW Oct. 14, p. 37). Of the $250 million, about $190 million was to have been spent in manned flight programs and $60 million in nuclear propulsion and space science projects.

Saturn 5 and the Lunar Excursion Module were selected for reprograming because they are not required for the early portions of the Apollo test program, which will be conducted with Saturn 1B vehicles in suborbital and earth orbital missions.

Effect of the slowdown on Saturn 5 and Lunar Excursion Module work will be to delay the first manned lunar landing an additional three or four months. Target date had been February, 1968. Earlier shippages pushed this to mid 1968 and the freeze order will probably delay the first landing flight to the fall of 1968, or early 1969.

Reprograming action is the second attempt within a month to cut costs in the Apollo program. In November, NASA eliminated six Saturn 1 Apollo flights (AW Nov. 4, p. 27). The agency said it would save $50 million in Fiscal 1964 and accomplish the same ends by accelerating the Saturn 1B program. Actual savings by not building the six Saturn 1 vehicles total $280 million. NASA put $230 million of this in the Saturn 1B acceleration.

No decision was made immediately on the precise nature of the reprograming in the nuclear and space science programs. However, one area which is likely to be cut in space sciences is funding for development of two 1965 Mariner Mars mission spacecraft (AW Dec. 9, p. 25). The missions will not be eliminated, but the size and complexity of the spacecraft, number of experiments and number and size of Mars landing capsules may be reduced.

President Johnson will decide, on the recommendation of the Budget Bureau, whether the Administration will request a Fiscal 1964 supplemental appropriation for NASA. Johnson has decided to retain chairmanship of the National Aeronautics and Space Council.

Webb made a lengthy presentation Dec. 10 to the Budget Bureau in support of a supplemental. The bureau's position is that the amount of a supplemental should be deducted from NASA's Fiscal 1965 budget request. Webb argued that such a course could merely repeat next year the difficulties the agency is having now.

Leadership of congressional space committees will support and fight for a supplemental, with no reduction in the $5.5 billion the Budget Bureau had planned to recommend for Fiscal 1965.

Decision of the Administration to authorize an Air Force manned orbital laboratory (see p. 30) may make it easier to push a supplemental appropriation through Congress next year and still obtain the desired funding level. Members of a Republican space policy group headed by Charles S. Gubser (R.-Calif.) have argued, in opposing the NASA appropriation, that the U. S. should have a military space station program. Congressional supporters of the space program feel the space laboratory decision weakens the opponents.

Congressional action on the $5.1 billion NASA appropriation for Fiscal 1964 was completed and the measure sent to the White House on Dec. 10. The House, which earlier had voted a prohibition against any use of Fiscal 1964 funds for a joint U. S.-USSR manned lunar landing program, accepted milder Senate language which requires the consent of Congress (AW Dec. 9, p. 28).

This is a breakdown of the Fiscal 1964 appropriation, compared with the Administration's original request:

	Requested	Appropriated
	(in millions of dollars)	
Research and development	4,351	3,926
Construction	800	680
Administration	561	494

T-38 Wires Severed

FBI was conducting a full-scale investigation into attempt at possible sabotage or vandalism at Williams AFB, Ariz., last week after electrical wires on 61 out of 77 of the station's Northtop T-38s were severed. A group of eight wires enclosed in a cable running up the side of each landing gear was cut on either the left or right gear, or in some cases, on both. Electrical signals from a microswitch actuated by the wires provide for a fan in the nose section which cools the electronic equipment, and prevent inadvertent gear retraction on the ground. All T-38s were back in commission Dec. 10, the day after the severed wires were discovered.

Network Bids Asked

Washington—Goddard Space Flight Center will award a multi-million dollar contract Apr. 1 for a unified S-band tracking and communications network for Project Apollo. Bidder response for the program is set for Jan. 3.

Goddard's Tracking and Data Systems Directorate will maintain technical responsibility for the system, which will transmit and receive spacecraft positioning information, voice and telemetry data simultaneously on a single frequency. The frequency will be divided into sub-carriers, which will be separated at ground receiving stations.

LOH Competition

Hiller Aircraft Co. OH-5A last week became the first of three entries in the Army's light observation helicopter (LOH) competition to gain the Federal Aviation Agency type inspection authorization a requirement in the Army contract. Delivery of the first OH-5A will be made later this month.

Bell OH-4A and Hughes OH-6A are also entered in the competition. Five of each model, all powered by the Allison T63 gas generator-free turbine engine will be evaluated for six months by the Army beginning early next year. Continental T65, which has passed its 50-hr. test is the backup engine chosen for the LOH. No decision has yet been made whether it will be installed in any of the aircraft.

AT&T Would Prefer Comsat Over Cables

Washington—American Telephone and Telegraph Co. last week told the Communications Satellite Corp. that if suitable North Atlantic satellite circuits are available by 1966 or 1967, it would prefer to use them rather than lay additional cables.

In a letter to Leo Welch, chairman of Communications Satellite Corp.'s board, James E. Dingman, AT&T executive vice-president, said the preference would continue at least "until the North Atlantic cross section was made up of approximately equal numbers of cable and satellite voice channels."

The decision to use the satellite network brightens Comsat's future, since AT&T is potentially its largest customer. The telephone company previously had considered laying a new transatlantic cable in 1967 or 1968 when the satellite network would be entering commercial use.

Dingman also pointed out that over 80 voice circuits between the U. S. and South America will be needed by 1966. He said that if sufficient satellite circuits will be available by that time AT&T will negotiate with South American communications companies to establish satellite connections first and cable connections later.

Life Sciences Work

Westinghouse Research Laboratories has organized a life sciences department to conduct research in the scientific interfaces that exist among the physical and biological sciences.

The department will continue Westinghouse's astrobiotics research on the effects of high-energy particles on living tissue.

Group Urged to Study Application Of Technology to Spur Economy

By Katherine Johnsen

Washington—Legislation establishing a top-level government commission to determine applications of aerospace technology to stimulate economic growth will have a high priority in the next session of Congress.

The prospect of a leveling off, or a possible downward trend, in military expenditures (AW Nov. 25, p. 29) has focused interest in the measure.

The Senate manpower subcommittee headed by Sen. Joseph S. Clark (D.-Pa.), is now drafting a report following several weeks of hearings (AW Dec. 9, p. 36). Aerospace leaders, United Auto Workers, and International Assn. of Machinists unanimously recommended the early creation of a "Commission on the Application of Technology to Community and Manpower Needs."

The commission would be composed of 14 members: eight appointed by the President from the fields of science, labor, industry, local government, and education; two appointed from the Senate; two from the House; and two from the National Academy of Sciences.

Industry witnesses proposed that the commission determine applications of aerospace technology for economic development throughout the world.

"The federal government having deliberately and necessarily stimulated the rate of defense spending cannot back away from its equally necessary mission and duty to the idled plants and displaced people to channel them into peaceful employment of their capabilities," Lawrence A. Hyland, vice president and general manager of Hughes Aircraft Co., commented in subcommittee testimony.

The type of commission ultimately to be recommended by the Clark subcommittee will probably have broad authority to deal also with the related economic problems created by automation—notably in the telephone and railroad industries.

Meanwhile, Defense Dept. is moving forward with its program to determine where defense money goes and which firms, industries, localities and regions would be affected by an alteration in the spending pattern. Aside from information on awards to prime contractors, the department has "very inadequate knowledge" in this area, according to Defense Comptroller Charles J. Hitch. It is a massive problem of tracing funds awarded to first-tier contractors as they are filtered down through layers of subcontractors spread throughout the country.

The department's first step is to take the five-year projection of military forces—such as strategic, air defense and conventional—and draw up a shopping list for each of the five fiscal years. These lists will give the number and cost for each type of item planned for purchase. For example, they will show how many guided missiles at what cost per missile will be bought during a given year.

The next step will be to translate these commodity listings into listings by industries. A missile purchase, for example, involves three industries in almost equal portions, as measured by employment: electrical machinery and equipment, aircraft and parts and ordnance. To a much lesser degree, a missile purchase also involves the watches and clocks industry. From these official breakdowns, the department will be able to determine the impact of an expenditure on a specific group.

The third aspect of the Defense Dept.'s problem is to attempt to determine—for five years in advance—the impact of its spending on geographical areas.

Over-all management of Defense Dept.'s economic impact project has been assigned to Institute of Defense Analysis.

Even with comprehensive information in hand, Hitch conceded "for much of the Defense program, we will probably never be able to forecast the impact on individual communities or plants."

Record Try Postponed

Los Angeles—Attempt to break a Russian held international altitude record of 113,892 ft. was postponed after the crash last week of an NF-104A piloted by Col. Charles E. (Chuck) Yeager, commandant of the USAF Aerospace Research Pilot School at Edwards AFB.

Yeager suffered second and third degree burns when he ejected at approximately 10,000 ft. Yeager was otherwise unhurt.

His aircraft, one of three NF-104As assigned to surpass the Russian record, went into a flat spin above 90,000 ft. It occurred in the descent phase of a ballistic arc which had peaked at roughly 102,000 ft. Recovery attempts including deployment of the landing drogue chute were unsuccessful. The aircraft spun into the ground after Yeager ejected.

Assault on the record, for aircraft taking off under their own power, was scheduled for Dec. 12.

Second YAT-28E Makes First Official Flight

First official flight of a second YAT-28E turboprop version of the T-28 trainer being evaluated for use in counter insurgency (COIN) operations, was successfully completed recently at North American Aviation's Columbus Div. The two-place aircraft is powered by a Lycoming T-55 turboprop engine developing 2,450 hp. Note rearward-facing camera behind pilot under canopy.

Single Defense Information Office Urged

Washington — General Accounting Office is recommending creation of a single Defense Dept information office to replace separate service offices, a move it claims will save $1 million annually by eliminating 112 military and civilian information jobs in the Pentagon.

The recommendation is made in a draft report being circulated for comment among the services. All services are preparing replies objecting to the proposal on the basis that it abrogates functions assigned to individual service secretaries. Arthur Sylvester, assistant defense secretary for public affairs, who would head the consolidated information office, has said he favors the move. GAO is believed to have made the study at the request of the Defense Dept comptroller.

Sylvester will receive formal service views on Dec. 16, when he will make his own written recommendations to Defense Secretary Robert S. McNamara.

If approved, the plan is expected to complicate and delay further the clearance of aerospace industry material for release. Industry long has complained about Defense Dept. process of clearing its press releases, photographs, films, brochures, speeches and corporate annual statements.

These are the principal points made by GAO:

• **Uneven** workloads caused by major events or catastrophes affecting one service result in one group working overtime, while the others have relatively little to do. The loss of the submarine Thresher last spring is cited as an example.

• **Duplication of effort** by the separate service offices is wasteful as are separate activities to maintain liaison with industrial associations, civic groups and the publishing industry.

• **Unified and specified commands** have become major sources of news. A combined office would be better able to contact them.

• **Many activities** of the service information organizations are subject to review by Sylvester's office. Labor involved in reviewing, editing and coordinating 2,000 releases per year with the services is excessive. Queries should go direct to the military commands.

• **Consolidation** is now working in the public affairs office as the result of a recent reorganization. An example is the review of motion pictures. "The staff is comprised of Army officers under a civilian head, but they review and act on films involving all of the services," the report said. Public affairs news desks also have been consolidated. Personnel can be reduced from 524 to 412 and the annual budget from $3.8 million to $2.8 million.

Service information officers have been instructed not to discuss the report, being referred to as "the Bookkeeper's approach to public information."

In addition to emphasizing the prerogatives of the service secretaries, the replies will discuss the following points:

• **Consolidation** of the defense information services was tried once before. In March, 1949, combination of the news services was started, and it was completed in a year. However, the combined office could not handle the greatly expanded press corps after the Korean war began, and public information activities were returned to the services. The situation would be the same today in an emergency.

• **Most unified and specified** coromands are based outside the U. S. and are oriented toward forces and operations. A large part of the information workload is related to material procurement and personnel. These are responsibilities of the services.

• **Service headquarters** here are organized to monitor all activities. The size of the Pentagon organization makes fragmentation of the information groups necessary. It would be impossible for any one public affairs officer to know all of the military commands and offices to call for information.

• **No matter what kind** of temporary emergency arose, some group in a service headquarters would have to coordinate communications with commands outside Washington.

• **Information budgets** have been reduced from a high of $12 million in Fiscal 1951. Further cuts would cause a breakdown in public and internal communications.

Saturn SA-5, Tiros 8 Readied for Flights

Cape Canaveral—Fifth Saturn research and development vehicle launching was delayed last week to January, but National Aeronautics and Space Administration plans to launch the eighth Tiros Meteorological satellite on schedule this week.

Saturn 5 will be the first flight of a live Saturn upper stage—Douglas Aircraft Co.'s S-4—and the first Block 2 version of the S-1 booster to be flown. It also will be the first vehicle to be launched from the Saturn Complex 37 here.

Block-2 models differ from the Block-1s, which were the first four Saturn S-1 vehicles to be flown in the program, in these respects:

- **Eight Rocketdyne H-1** engines now are rated at 188,000 lb thrust each, for a total stage thrust of 1,504,000 lb. In the Block-1 S-1, the H-1s were rated at 165,000 lb. thrust each, for a total of 1,320,000 lb. thrust.
- **Propellant capacity is increased** by 100,000 lb. from the 750,000 lb. of the Block-1 to the present 850,000 lb. of the Block-2. This increased capacity has been achieved by lengthening the nine propellant tanks 6 ft. each. The 7.4 ft.-tall instrumentation area which capped the forward end of the Block 1s has been eliminated from the Block 2s, so that the over-all length of the S-1 has decreased from 81.6 ft. to 80.2 ft. Additional propellants provide about 30 sec. longer burning time for the Block 2 models.
- **Four stabilizing fins**, each 120 sq. ft. in area, and four stub fins, each 50 sq. ft., have been added to the base of the Block-2 units. Fins provide launch pad attachment points and hold down clamps as well as aerodynamic stability. Three of the stub fins house liquid hydrogen vent lines from the S-4 second stage.

One of the primary objectives of the SA-5 flight will be the evaluation of the Pratt & Whitney RL-10 propulsion system on the S-4 stage. Six of these 15,000 lb. thrust engines power the S-4 and are nearly identical to the engines which power the Centaur stage (AW Dec. 9, p. 30). The engines are expected to burn for about 480 sec. and should drive the entire stage into an elliptical earth orbit of 160 400 stat. mi., although achievement of an orbit is considered to be of no consequence to the mission. Centaur was similarly flown.

If orbit is achieved, the hardware will represent the heaviest and most useless weight yet orbited by the United States. Total weight in orbit of 37,700 lb. breaks down this way: spent S-4, 14,300 lb.; instrument unit, which contains the guidance system and most of the instrumentation, 5,200 lb.; adapter section between the S-4 and payload fairing, 4 000 lb.; the fairing itself, 2,500 lb.; ballast in lieu of a useful payload, 11,600 lb., and miscellaneous equipment, 100 lb.

SA-5 will carry a tracking beacon on the S-4 stage, which—if successfully orbited—will be tracked by all U. S. stations around the world. At one time, there was considerable speculation that the stage might also carry a tape recorded message from the late President John F. Kennedy, but NASA officials claim they know of no such plans.

Saturn SA-5 also will carry eight movie cameras and a television camera (AW Apr. 8, p. 29 and AW Nov. 26, 1962, p. 87) to record liquid oxygen behavior in two propellant tanks, S-4 engine operations, stage separation, and the firing of both S-1 retrorockets and S-4 ullage rockets. The movie cameras will be jettisoned shortly after stage separation and hopefully will be recovered downrange since each is contained within a combination parachute-flotation capsule. The TV camera will remain with the vehicle and will transmit pictures to downrange stations until the moment of impact in the ocean.

Tiros 8 will be the first in this family of meteorological satellites to carry the Automatic Picture Transmission (APT) camera system developed by Radio Corp. of America (AW June 24, p. 38). The camera employs an electrostatic storage vidicon, which will be exposed to the cloud cover of the earth for about 40 millisec. per exposure. The camera then automatically will transmit the picture during a 200-sec. read-out period to all ground stations within reach. The camera will operate only during sunlit hours and will be superceded by the conventional camera also aboard the satellite whenever there is an especially important meteorological event which the weather bureau might want to record on tape. The APT camera lacks storage capability for later playback—it must transmit what it sees at that moment, regardless of its position relative to ground stations.

About 50 U. S. weather stations and several foreign stations are expected to have their low-cost APT receiving kits installed in time for Tiros 8 operations.

Tiros 8 was described by one program official as the best spacecraft to be built so far in the program. It took only 21 days to run through acceptance tests, the fastest time yet chalked up by any satellite in the Tiros program.

New Goddard Award

New York—New Goddard award, honoring Dr. Robert H. Goddard, will include a $10,000 cash prize and a gold medal presented annually to an outstanding aerospace engineer or scientist.

The American Institute of Aeronautics and Astronautics will present the first award at an honors night dinner next June. Cash is donated by United Aircraft Corp. Medals will come from the Goddard fund established by Dr. Goddard's widow.

Awards will go to the man "who has made an outstanding discovery, or a series of outstanding technical contributions over a period of time, in the fields of propulsion or energy conversion." It also may be presented for outstanding scientific or engineering creativity outside those fields.

William H. Pickering, president of the Institute, and William P. Gwinn, president of United, announced the award. Pickering said it would be the highest honor bestowed by the Institute. An awards committee to select the annual winner will be headed by Dr. C. Richard Soderberg, former dean of the Massachusetts Institute of Technology school of engineering and a professor emeritus there.

Space Guidance Study

Los Angeles—Air Force last week notified four avionics companies it would begin negotiations with them for parallel four-month program definition phase studies of its standardized space guidance system, a system to be capable of providing Titan 3 with guidance during boost, orbital injection, rendezvous and re-entry operations (AW Sept. 30, p. 30).

The four companies listed with team members or major potential subcontractors are:

- International Business Machines with Northronics.
- Sperry Rand Corp. and Kollsman.
- Space Technology Laboratories with General Precision and Univac Div. of Sperry Rand Corp.
- North American Aviation's Space & Information Systems and Autonetics Divisions.

Ultimately, if the standardized space guidance system reaches production it may become the largest single Air Force spaceborne guidance procurement. It is intended for use on later complicated Titan 3 space missions. Currently, Titan 3 is expected to use a modified AC Spark Plug Titan 2 guidance system.

Tyco Probe Spurs AF Contracting Reform

By George C. Wilson

Washington—House Armed Services Committee will demand sweeping reforms in Air Force research contracting as a result of its probe of a Tyco Laboratories contract that uncovered what the investigating chairman called "as sloppy a contracting operation as I have ever encountered."

Air Force says it already is moving to make changes—which it refuses to discuss—in anticipation of the stinging congressional report expected to be issued within the next few days. But even with these self-imposed reforms, the whole Air Force concept of basic research contracting is being challenged by Congress.

These basic questions, all of significance to the aerospace industry, are being asked by the House Special Investigations Subcommittee as a result of its probe of the Air Force contract with Tyco Laboratories of Waltham, Mass.:

- **Is enough forethought**—especially as to the ultimate cost—going into research contracts before they are let?
- **Is a clique developing** between Air Force research leaders and private laboratories that works against open competition for contracts?
- **Is the Air Force giving** too much contracting power to scientists who disregard the usual administrative requirements, such as keeping detailed records to justify committing large sums of money?
- **Are the Air Force guidelines** for contracting officers so contradictory that final responsibility is not fixed?

It is becoming increasingly obvious that the Air Force will have to answer these and related questions next year if it expects Congress to appropriate the money it requests for research (AW Dec. 9, p. 26). Chairman Porter Hardy, Jr., (D-Va.) of the Special Investigations Subcommittee said the Tyco case "is about as sloppy a contracting operation as I have ever encountered, and I have seen a lot of them since I have been here. I wouldn't have believed that it could happen in government procurement if I hadn't heard some of this testimony." He stressed he was not criticising Tyco, but rather the contracting operations of the Air Force. He said Tyco was a typical case.

Here is the background as developed by the subcommittee:

- **Principals.** Dr. Norman (no middle initial) Rosenberg, chief of the energetics branch of the Air Force Cambridge Research Laboratories at Hanscom Field, Bedford, Mass. Those laboratories are under the Air Force Office of Aerospace Research commanded by Maj. Gen. Don Ostrander. OAR is not under the Air Force Systems Command. But since AFSC is the landlord at Hanscom Field, its Electronic Systems Div. does the procurement for such tenants as the Cambridge laboratories, and did so in the Tyco case. Dr. Norman Rosenberg initiated the Tyco contract and has been in charge of it all along. He is not related to any of the other Rosenbergs in the Tyco case, and will be identified hereafter as Dr. Norman Rusenberg.

Dr. Norman Wolfson "Bub" Rosenberg is chief of the chemical physics branch at Cambridge laboratories and is a brother of two officers at Tyco: Dr. Arthur Rosenberg, president, and Paul Rosenberg, treasurer. Two of Dr. Bob Rosenberg's subordinates, Robert E. Huffman and Samuel P. Zimmerman, were on the eight-member team that evaluated the Tyco proposal.

- **Contract sequence.** Dr. Norman Rosenberg in 1961 initiated a sole-source, $43,902 contract with Tyco to do basic research on "the surface barrier effect through which polycrystalline and semi-conducting films may be used as efficient solar energy converters." He also initiated the enlargement of the contract amount from $43,902 to $78,657—again without competitive bidding. The first contract was scheduled to expire in one year, on May 15, 1962. It was extended to July 15, 1963 on Sept. 29, 1961—at a time when the first contract was far from completed. Dr. Norman Rosenberg attempted a third extension in 1962, which would have increased the amount by $250,000. But instead, USAF at this point conducted a controversial competition where Tyco emerged as the winner of a $1,150,000 contract. Air Force said the effective date of this contract was May 6, 1963. Rep. Hardy said the Air Force estimates the total cost of the contract may run as high as $10 million.

The subcommittee hearings developed these points:

- **Dr. Norman Rosenberg** could not find his copy of the Tyco proposal which inspired the first contract award and was hazy on related details.
- **No firm outside** the geographic area of the laboratory was allowed to enter the ultimate competition for the $1,150,000 contract.
- **Tyco was selected** for the contract award before the Air Force had any formal report showing the firm had the facilities and manpower to do the job.
- **No detailed conflict-of-interest** investigation was conducted by the Air Force, even though the judge advocate's office requested one.
- **Much of the contract dollars** would go for capital equipment rather than research since Tyco did not have enough facilities of its own.
- **Dr. Norman Rosenberg** suggested that Tyco increase its request for $6,000 in travel funds to $20,000 in the final contract.

Testimony added further details on:

- **Initial proposal.** When the subcommittee investigation started, Dr. Norman Rosenberg said he could not find the unsolicited proposal from Tyco which led him to recommend award of the basic research contract. He subsequently obtained what he believed was a duplicate from Tyco. He said at the Nov. 12 subcommittee hearing that he did not make any systematic check to see if other firms were already doing the kind of research suggested by Tyco. Instead, he said, he relied on his previous experience and knowledge of the field. He said he decided on the sole-source approach with Tyco because its work in the field of traveling solvent method of crystal growth was proprietary, in his opinion.

Rep. Hardy told Dr. Norman Rosenberg that "you don't keep any kinds of records, apparently. It bothers me you didn't even keep a copy of the original proposal. . . . You are fundamentally a scientist and trying to apply this to practical operations. And that is why I wonder whether you are competent to do administrative work." At another point, Rep. Hardy said Dr. Norman Rosenberg decided on sole source without conducting an adequate investigation to see if Tyco's work was indeed proprietary.

- **Geographic restriction.** Only research firms in the immediate area of the Cambridge laboratories were invited to compete for the $1,150,000 contract. Dr. Norman Rosenberg recommended three sources for the award: Tyco, Thermo electronic Engineering Corp. of Waltham, Mass., and Ionics, Inc., of Cambridge, Mass. He told the subcommittee this geographic limitation was imposed to ensure close relationship with the contractor.

Thomas E. Duffey, chief of the contracts division within the Electronic Systems Div. at Hanscom Field, reviewed the proposed Tyco contract on June 10, 1963, and concluded it was "legally insufficient." He said the solicitation was "very limited and restricted" and that the geographical limitation "dampens competition." The office of the Air Force secretary, in its White Paper to the subcommittee about the investigation, said there was nothing illegal about imposing geographic limitations.

- **Facilities report.** Duffey said that to perform the contract, Tyco would have to more than double its payroll—from 40 to 90 persons—and lease facilities. He said the government would have to furnish about $250,000 worth of facilities and that Tyco's own plant and equipment leasing would run another $225,000—all chargeable as cost in the contract. Despite this "substantial deficiency," Duffey said no facility capability report was obtained as required. John J. White, who negotiated the contract for the Air Force, said on Nov. 13 that such a report was needed from a manufacturing firm, "but certainly not a basic research firm. . . . An industrial engineer is not qualified to judge the content of a scientist's mind, and that is the thing that we are buying." However, White and the Air Force paper contend a facilities capability report was obtained July 5, 1963, because the omission had become controversial. The actual contract with Tyco was dated June 28, but the Air Force paper contended the final signing was July 11.

- **Conflict of interest.** Col. Edgar P. Farnell, staff judge advocate of the Electronic Systems Div. at Hanscom Field June 10, 1963, in his review of the proposed Tyco contract said that since Huffman and Zimmerman evaluated the contract while they were under Dr. Bob Rosenberg, "additional inquiry should be made" to make sure they acted independently in their evaluation "without advice, counsel, direct or indirect suggestion from Mr. [Bob] Rosenberg."

Col. Gene M. DeGiacomo, assistant deputy for plans and programs at Cambridge laboratories, was asked by White and Dr. Norman Rosenberg for a "piece of paper" concerning the conflict of interest issue. Col. DeGiacomo said "at no time did I hear the words 'separate independent investigation'." Consequently, his inquiry was limited to talking to Dr. Bob Rosenberg about his connections with his brothers' firm, Tyco. Col. DeGiacomo said he did not talk to Huffman or Zimmerman as part of this conflict of interest inquiry.

Col. DeGiacomo said Dr. Bob Rosenberg and his brothers at Tyco "separated in their ways of business and life long, long ago. . . ." The Air Force White Paper said "there was no evidence of conflict of interest." It stated further that officials at the Cambridge laboratories felt "a top-to-bottom investigation might have been a sore spot with government scientists."

- **Capital equipment.** Duffey said spending so much for this amounted to a misdirection of research funds. But Air Force officials defending the Tyco award argued the contract was "a sound business arrangement for the government."
- **Travel allowance.** White said "We felt the magnitude of this program called for beefing up of the travel costs," declaring the increase from $6,000 to $20,000 would be used partially to cover attendance at scientific meetings. Rep. Charles S. Gubser (R.-Calif.), subcommittee member, said this increase was made while restricting the hidders "to one hour's driving time of the Cambridge base to cut down on travel."

S-4B Battleship Tests

Los Angeles — Cold-flow battleship tests of the Douglas S-4B Saturn stage are expected to begin on schedule early next spring following the recent receipt of the cold-flow J-2 test engine from North American Aviation, Inc.'s Rocketdyne Div.

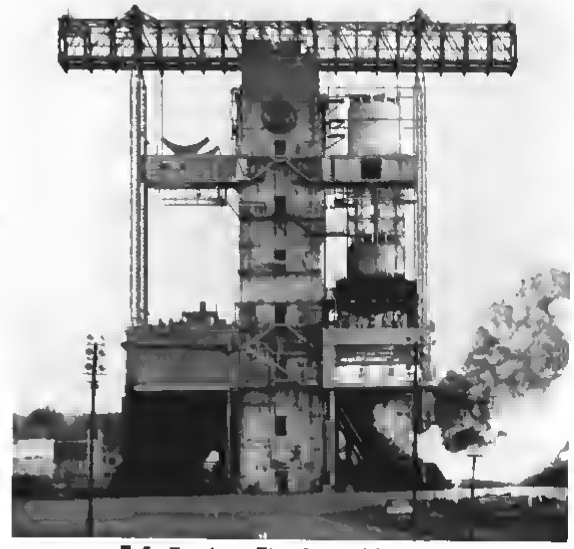
After checkout at Douglas' Space Systems Center in Huntington Beach, Calif., the test version of the 200,000-lb.-thrust liquid hydrogen-fueled engine will be sent to the company's field station at Sacramento, Calif., for installation and propulsion system testing in the battleship vehicle.

First hot-firing tests with the battleship S-4B are planned later in the spring. S-4B will serve as second stage of Saturn 1B and third stage of Saturn 5.

Blue Streak Test

Woomera, Australia—Ground compatibility tests of the Hawker Siddeley Dynamics Blue Streak dummy round were completed here last week with a 20-sec. static test firing, the second made at the new European Launcher Development Organization (ELDO) Pad 6A (AW Dec. 9, p. 66).

The trial was completed within two days of the schedule established more than a year ago to establish firing a sequence for the ELDO first stage vehicle. The actual flight round is being shipped by Hawker Dynamics this week from its Stevenage, England, production facility. First flight is scheduled next April.



F-1 Engine Fired at Marshall

Short-duration test firings of the 1.5-million lb. thrust F-1 engine began recently at National Aeronautics and Space Administration's Marshall Space Flight Center. Longest firing to date has been 10 sec., on Dec. 5. Tests are in the modified right half of the dual position stand originally built for the Saturn S-1 stage. Bulk of the firings will be kept short but Marshall gradually will extend their length to 120 sec. Five F-1s will power first stage of the Saturn 5 rocket for the manned Apollo lunar mission. Note vibrations of tower during firing sequence above.

Boeing Studies Withdrawal From SST

Boeing Co last week was seriously considering withdrawing from the supersonic transport airframe competition after re-appraising the financial and technical risks involved (AW Nov 25, p 38). Boeing, Lockheed and North American have told Federal Aviation Agency that they would compete for the airframe.

Cancellation of the Dyna Soar program (see p 30) is expected to have a further depressing effect on the company's flagging enthusiasm for the supersonic program. Some in Boeing feel that the government could cancel the transport late in development as it did with Dyna-Soar. Boeing is considered a front-runner in Air Force's manned orbiting laboratory competition, but it is not known what effect this contract would have on the company's supersonic transport viewpoint.

Boeing is continuing to work on its transport proposal, but a decision on withdrawing from the FAA-sponsored program may be made before the proposal submission deadline of Jan 15. Supporters of the program at Boeing, mainly at the project level, are encountering increasingly stiff resistance to their attempts to convince management that the program should be continued. The company has already spent over $17 million in research on the supersonic transport.

Boeing's doubts about the financial risk involved were summed up by its president, William M Allen, in congressional hearings when he said that the government must be prepared to render greater financial assistance than the 75% presently proposed.

Mirage 3V VTOL Flight Delayed

Paris—Development problems with the main propulsion engine will delay the first flight of the Dassault Mirage 3V VTOL prototype fighter.

No fixed date for the Mirage 3V initial flight has been officially established but the flight was expected in early 1964. Engine development difficulties probably will mean a postponement of several months. French authorities, however, maintain that the overall program probably will be kept on schedule.

Mirage 3V, of which two prototypes are on order, is to be equipped with eight Rolls-Royce RB.162 lift engines and a single Snecma TF-106 afterburning turbofan.

Snd Aviation recently delivered the first Mirage 3V airframe to Dassault.

A smaller version of the Mirage 3V, the Dassault Balzac, has been flying for more than a year. The Balzac is powered by eight Rolls-Royce RB.108 lift engines and a single Bristol Orpheus turbojet.

Current engine difficulties center on Snecma's development of the TF-106 turbofan engine. The TF-106 is basically a Pratt & Whitney JTF-10 fitted with a Snecma-designed and developed afterburner. In its fully developed version, the TF-106 is expected to produce about 20,000 lb thrust with afterburning.

First stage development of the TF-106 has been designated TF-104 by Snecma. The TF-104 engine uses reheating but not complete afterburning. The first TF-104 has been fitted into a Mirage fighter testbed, designated Mirage 3T-1 (AW June 10, p 100).

Mirage 3T-1 was scheduled to make its first flight in October. The aircraft aborted its first flight attempt that month, however, because of a compressor stall during takeoff. Dassault and Snecma are studying various modifications to correct the problem.

Pratt & Whitney, which has a technical advisory agreement with Snecma on the TF-106 development program, has no engineering responsibility in the project. When Snecma began the TF-106 project, Pratt & Whitney had not carried out much development work on the JTF-10 turbofan. But since this engine has become involved in the General Dynamics F-111 (TFX) program as the TF-30, Snecma has been aided by U. S. development funds.

Initially, U. S. security prevented Pratt & Whitney from passing on TF-30 development data to Snecma but this obstacle has been removed.

New Transit Launched

Los Angeles—Another Navy Transit satellite was placed in orbit Dec 5 as part of a dual payload launch from Vandenberg AFB with a Thor Ablestar booster. The restartable Space General Ablestar placed the Transit payload into a near-circular orbit of 603 naut. mi apogee and 574 naut. mi. perigee. Launch inclination was 89.96 deg.

The Transit satellite was the second launched this fall from Vandenberg and is powered by a Snap-9A radioisotope generator developed by Martin Co.'s Nuclear Div. The other Transit satellite, Transit 5B (AW Oct. 7, p. 37) was placed into orbit upside down Sept 28 also on a dual payload launch with the gravity gradient stabilization system pointed upward, rather than downward (AW Nov. 25, p. 34). No identification has been made of the other payload in either launch.

News Digest

Advanced Supersonic V/STOL tactical fighter weapons system will be studied by Republic Aviation Corp and Boeing Co under separate $600,000 contracts awarded by USAF Aeronautical Systems Div. The contracts call for establishment of a final design configuration and identification of all subsystems and logistics support requirements.

Scout requalification flight, scheduled for Dec 19 at the Pacific Missile Range, has been postponed until after the first of the year. Although NASA will launch a 12-ft inflatable sphere with the Scout in an air density/drag experiment, primary purpose of the flight is to determine whether technical difficulties in the vehicle (AW Nov. 11, p 34) have been solved.

North American Aviation's Rocketdyne Div successfully test fired a liquid hydrogen J-2 rocket engine for 500 sec. recently. This was the first long duration firing of the J-2, which originally was designed for a 250-sec. firing.

Maj. Gen. E. B. LeBailly will replace Maj. Gen William Martin as Air Force director of information. Gen. Martin becomes assistant deputy chief of staff for personnel.

United Aircraft Corp.'s Hamilton Standard Div. has been awarded an $8.3-million contract from Grumman for the Lunar Excursion Module environmental control system. Hamilton Standard has been working on the project under a letter contract since July (AW July 22, p 109).

Navy successfully launched a Polaris A-3 missile from a land pad at Cape Canaveral Dec 9 on a 2,000 mi flight down the Atlantic Missile Range. A second A-3, launched from the rear deck of the USS Observation Island Dec 11 was destroyed after 50 sec. of flight when it veered off course.

Boeing, Hughes, Lockheed, Martin and Space Technology are finalists in NASA's lunar orbiter competition (AW Sept 9, p 29).

Solid Motor Restart

Washington—Amcel Propulsion Co has stopped, restarted and throttled a single solid propellant rocket motor through five complete cycles.

The test, USAF Systems Command said, is the first in which a solid fueled motor demonstrated this flexibility, involved only a single moving part for stopping and restarting.

Jet Procedures in Turbulence Changed

FAA, Boeing revisions emphasize effect of rough weather on turbojets; series of accidents is studied.

By Robert H. Cook

Washington—Sensitivity of swept wing turbojet aircraft to turbulent weather conditions, emphasized by a series of fatal accidents and dangerous incidents this year, is forcing a general revision of airline flight operating procedures, spurred by recommendations of the government and the Boeing Co.

While none of the recommendations for manual changes made by the Federal Aviation Agency or the Boeing Co alluded directly to turbulence as a primary cause of accidents, they underscored the difference between the turbojets' handling qualities and those of piston-engine aircraft under adverse weather conditions. In particular, they stressed the narrow margin for error in avoiding a stall in such weather.

Last August, shortly after a United Air Lines Boeing 720 plunged out of control over Nebraska, FAA issued a detailed three-page recommendation urging airline pilots to maintain control over aircraft attitude, rather than speed, when encountering turbulent conditions. The agency warned them not to make any attempt to correct the erratic fluctuations of air speed indicators by changing power, but to concentrate upon keeping the wings level and the correct attitude necessary to retain control of the aircraft and avoid a stall. If at all possible, FAA emphasized, that flights should avoid all turbulent areas.

As a result, several airlines are now modifying their attitude indicators to give pilots a more accurate and easily interpreted reference point. A major design change has been made in the nose-up attitude scale.

Boeing followed with a recommendation that users of the 707 series increase their turbulence penetration speed to avert the possibility of a stall condition and loss of control. The manufacturer suggested an indicated air speed of 270 kt., as compated with the previous recommended speed range for penetration of 220 to 250 kt.

Douglas said it has been reviewing the problem because of the accidents, but does not feel any change in its recommended penetration speed is necessary at this time. Convair Div. of General Dynamics has taken a similar stand.

Airline operators have placed the new recommendations into effect but generally discount any suspicion that the chain of accidents and incidents is directly attributable to turbulence aloft. They concede that while the aircraft is far more sensitive to abrupt or severe weather changes, because of its size and design, any operational problems experienced so far can be solved by concentrating upon flight training and operational procedures designed to cope with the problem. They add that the turbojets have been flying in bad weather conditions for more than four years without any concrete evidence that they are unusually susceptible to turbulence. On this basis, the carriers see no plausible link between the series of happenings this year.

Although FAA has issued its recommendations it does not recognize any conclusive pattern in the accidents and incidents and last week refused a plea of Rep. Sumner Stratton (D-N.Y.) that 707 operations be restricted in areas of known turbulence.

However, the Civil Aeronautics Board, now investigating the Dec. 8 fatal crash of a Pan American World Airways Boeing 707 during turbulence near Elkton, Md. (see box) is not convinced that the airlines' attitude is correct. Beyond the series of accidents that have claimed 242 lives and the incidents that were not investigated since there were no fatalities, Board sources point out there have been many other similar incidents that were not publicized.

Although it may be some time before the CAB can determine the probable cause of the Elkton crash, Board sources indicate it is highly probable that CAB will add its own set of recommendations for turbojet operations in turbulence to those already made.

Here is the chain of accidents, some still under investigation, and incidents that have made the subject of turbojet operations in turbulence a controversial subject in the industry:

- **Northwest Airlines** lost a Boeing 720 with 43 people last Feb. 12 in a squall near Miami. The aircraft was carried to an altitude of 19,000 ft in a violent updraft, then nosed down in a dive which culminated in disintegration at 6,000 ft over the Everglades.
- **United Air Lines** had an "incident" on July 12 near O'Neill, Neb., when a

Turbulence Studied in Maryland Crash

Washington—Civil Aeronautics Board probe into the crash of a Pan American World Airways Boeing 707 turbojet transport near Elkton, Md. Dec. 8 had made little progress toward finding the cause of the accident by late last week, although extreme turbulence was being considered a factor.

Aluminum foil tape in the flight recorder was crushed in the accident, but CAB investigators were attempting last week to reconstruct the tape to determine aircraft speed, altitude, heading and stresses it had encountered. Plane crashed while in a traffic pattern waiting for a clearance to land at Philadelphia 28 min. after taking off from Baltimore on the final segment of a flight from San Juan, Puerto Rico.

About 5 in. of the flight tape records the portion of the trip from the Baltimore takeoff to the crash. CAB officials called the damaged tape the "worst we've handled" but they were optimistic that some data can be obtained from it.

Crash killed 81 persons, and wreckage was scattered in small pieces over an area of 1 sq. mi. Aircraft had flown nonstop from San Juan to Baltimore with 144 persons on board. CAB will analyze portions of the wreckage at Bolling AFB.

Transcript of messages between air traffic controllers at Philadelphia and the aircraft disclose that a severe line squall was in the area at the time of the crash. The Pan American transport was sixth in the traffic pattern, and elected to hold in the pattern until the high winds passed the area. A crewman on a nearby National Airlines DC-8 in the traffic pattern, who witnessed the start of the disaster, reported it to controllers.

He said, "Clipper 214 out of control . . . here we go." A controller asked, "Clipper 214, did you call Philadelphia?" and the crewman answered, "Clipper 214 is going down in flames . . ."

Meanwhile, a U.S. accident investigation team consisting of four CAB and four Federal Aviation Agency investigators joined Canadian experts in seeking the cause of a Trans-Canada Air Lines Douglas DC-8 crash near Montreal Nov. 30 in which 118 persons perished.

Air France Management Faces Shakeup

Paris—French government's dissatisfaction with the growing deficits of Air France may lead shortly to a major management shakeup

Officially, such a move is denied by interested government services. Yet well-informed sources insist the government is considering several possibilities to improve Air France's financial situation and a top-level management change is one such possibility. Pierre Cot, 52 year-old director of the Paris Airport Authority, is said to be in line for a top managerial post with the nationally owned carrier.

Air France is expected to run a deficit this year of some $20 million, much the same as in 1962. This deficit is based on actual operating figures, and can't be compared with the carrier's much smaller balance sheet deficit calculated after government subsidies are taken into account. The government currently is negotiating a new convention with Air France under which the subsidy payment for 1964 would be held to $12 million.

Unlike the publicity given to national airline financial troubles in other European countries, very little public interest is being stirred up here by Air France's problem. For one thing, most French citizens normally assume their national carrier is running high deficits, much as does the nationalized railroads.

Recently, however, interested officials have begun to question whether Air France management could not handle the situation better. Air France officials, on the other hand, often put the blame for their problems on the shoulders of the government for imposing an impossible mission on the national carrier.

Air France, they say, is expected to run a prestige operation and yet make money. They further argue that government officials, while urging Air France to operate more efficiently, cripple the national carrier by permitting the growth of competitive French carriers (AW Nov. 11, p. 46).

Air France critics, however, claim the carrier's main problem stems from management miscalculation over future expansion. This, it is claimed, led carrier officials into ordering more equipment than was necessary. Then, too, Air France has more personnel than Pan American World Airways and yet its traffic is considerably less. Air France currently employs about 25,700.

Boeing 720 plummeted out of control from 39,000 ft., recovering normal control at 11,900 ft. Weather radar in the aircraft showed a turbulence area 50 mi. to the right of the flight and speed was reduced. About 35 mi. from the area, the aircraft unexpectedly went into a dive. Pilots reported that the instruments shook so severely, and were so erratic, they could not be read. Aircraft skin was wrinkled in several areas.

▪ **Eastern Air Lines'** Douglas DC-8, departing Dulles Airport on Aug. 21, hit severe turbulence while in a climb-out at 4,000 ft. The flight returned to Dulles for a close inspection and departed later.

▪ **Eastern's second incident,** near Houston, Tex., on Nov. 9, was far more hazardous. A DC-8, caught in a powerful updraft that carried it to 19,000 ft., stalled and nosed down into an uncontrolled dive that was not broken until the pilot applied engine thrust reversers at 6,000 ft. The resultant pull-out was so violent it tore away the right inboard engine, but the aircraft landed safely. Several persons aboard were injured.

▪ **Trans Canada Airlines** DC-8 crashed with a loss of 118 lives on Nov. 29 shortly after takeoff from Montreal during a heavy rain storm.

Because of its long experience with turbojet aircraft, the U.S. Air Force maintains a continuing record of accidents and incidents attributed to both known turbulence and clear air turbulence. Last year, the Air Force recorded 381 accidents, involving both turbojet and piston-engine equipment, in which turbulent weather was a factor. In the same period there were more than 5,000 incidents reported.

New Rules on Charters Limit Bermuda Flights

New York—Bermuda has imposed restrictions on incoming charter flights to offset overcrowding of its airport and hotel facilities, and to maintain a "quality level" on its tourist business.

The restrictions include a total ban on any charter operations during the Easter and college spring holiday period from Mar. 15 to Apr. 30, a time of heavy traffic volume. Spokesmen said the ban was necessary because of the growing number of charter flights to the island in recent years.

"Last year we had hundreds of college students arrive without any prior notice, and we were hard pressed to find places for them to stay," one official said.

Another spokesman said that Bermuda has traditionally catered to a higher class clientele, and that it is content with an annual tourism growth of 2-5% from this category.

"We're not interested in catering to bargain-basement tourists," he said.

The new charter rules require any carrier to give 60 days notice before the flight. Parking space is limited at Bermuda's Kindley Field, a joint military-civil airport, and charter aircraft are now required to depart by noon the day after arrival. When their flight involves only one charter group staying several days, many operators may have to return empty to the U.S. and fly empty back to Bermuda for the group. Higher fares may result.

Bermuda had considered restricting air traffic to the three airlines regularly serving the island — Pan American World Airways, Eastern Air Lines and British Overseas Airways Corp. Government sources in both the U.S. and Britain, however, objected to this move.

Some objection to the new rules has already come from travel agents. But Bermuda officials stress that they want to keep the island's tourism on a high-quality level, and want to avoid any student incidents such as those in Ft. Lauderdale, Fla.

"We have always invited college students to Bermuda for the spring holidays," one spokesman said. "But sleeping on the beach is strictly prohibited."

Female groups have always been required to have a chaperone. And Bermuda now insists on male supervision for male groups as well. The island provides group recreation for all college tourists to discourage free-wheeling activities that get out of hand.

Airline Strike Averted

Washington—Nationwide strike against six major airlines by the International Assn. of Machinists was averted last week by White House intervention.

President Johnson invoked powers of the Railway Labor Act by establishing an emergency fact-finding board to investigate the labor disputes on Continental, National, Northwest, Bramiff, Eastern and Trans World Airlines. The action forestalls any IAM strike against these airlines for a period of 60 days, half of which will be used for the Board's investigation and recommendation of settlement terms. The balance is to be a cooling-off period in which both the carriers and the union are barred from changing the status quo.

Meanwhile, the union has scheduled a strike against United Air Lines this Friday. All provisions of the Railway Labor Act covering negotiations, plus the 60-day delay under a separate emergency fact-finding board, have been exhausted in this case. Recommendations made in the United strike situation on Nov. 18 were rejected by the union and IAM is legally free to strike. President Johnson has been asked to intervene personally to ward off the planned strike scheduled during the airline industry's heaviest holiday travel season.

North Atlantic Fares Compromise Reached

Compromise agreement on sharp reductions in general passenger fares on North Atlantic routes was reached last week by a working group of the International Air Transport Assn. traffic conference in a special session held in Nassau, Bahamas.

The new rate formula closely follows the pattern agreed upon earlier by British Overseas Airways Corp. and Pan American World Airways first reported in Aviation Week & Space Technology (Dec. 9, p. 38). Formal approval of the proposed tariff by the airlines and governments involved is necessary before the reductions can be placed into effect April 1, but no further difficulties are anticipated by traffic conference delegates.

These are the new fares agreed upon:

- First-class fares will be sliced by $100. New York-London fare, for example, will be dropped from $475 to $375.
- Economy fares will be cut $53. The new fare, $210 one way New York-London compared with the previous $263, will be effective in all but 10½ weeks of the year, when the economy fare will be $250.
- Excursion fares will be reduced from $350 to $300 and will be valid for 21 days with a minimum stay of 14 days at destination. Group fares will remain at the present level.

Controversial group fare may still cause some dissension within traffic conference ranks, but feeling is now strong that opponents of this type of fare will accept it in order to break the deadlock that followed the collapse of the two Salzburg conferences (AW Nov. 18, p. 36).

Both El Al and Irish Airlines have strongly advocated the group fare plan, and attempts by opponents to adjust the conditions of this promotional fare to make it less attractive reportedly failed.

Pan Am May Buy Sikorsky S-61Ns For World's Fair Sightseeing

New York—Pan American World Airways is discussing the purchase of two S-61N helicopters from Sikorsky Aircraft for sightseeing excursions at the 1964-65 New York World's Fair.

A plan under discussion would involve Pan American's leasing the two aircraft to New York Airways, which would operate them from the roof of the New York Port Authority exhibition building at the fair. The proposal also includes the lease of a third S-61N by New York Airways directly from Sikorsky.

Pan American also wants the 27-passenger S-61N to be authorized to operate from the roof of its executive headquarters in midtown New York. Most sources feel it is unlikely that city authorities will soon clear the rooftop operation for New York Airway's Boeing Vertol V-107-2 equipment —and probably any other helicopter— due to a fatal crash on Oct. 14 at Idlewild Airport (AW Oct. 28, p. 34). That crash was due to failure of a quill shaft resulting in collision of the V-107's twin rotors.

Those involved in the present discussions, however, speculate that the city might look favorably upon the single-rotor S-61N as more suitable to fly from the Pan Am building roof.

In addition to flying the sightseeing service, New York Airways also would provide helicopter shuttle service between New York's three airports and the fair with its three V-107s. The rooftop heliport at the fair has been leased to United Aircraft Corp., of which Sikorsky is a division.

New York Airways has been seeking a replacement for the V-107 lost in the Idlewild accident, a quest complicated by Boeing Vertol's having discontinued production of commercial versions of the aircraft. Robert L. Cummings, Jr., president of the airline returned recently from Japan where he talked with officials of Kawasaki Aircraft Co., Ltd., which builds the V-107 under license. Kawasaki, however, has production commitments that prevent it from filling New York Airway's immediate need for a V-107.

FAA, CAB Funds

Washington—Legislation providing Fiscal 1964 funding for the Civil Aeronautics Board and the Federal Aviation Agency was sent to the White House last week. Both amounts were smaller than Fiscal 1963 appropriations.

House-Senate conferees arrived at a CAB total of $89,240,000, compared with $92,314,000 appropriated for Fiscal 1963. FAA funding included $60 million for supersonic transport development compared with $20 million for Fiscal 1963, but the overall budget dropped from the Fiscal 1963 total of $775,881,600 to $758,341,500.

CAB Hears Complaints By Miami Beach Hotels

Washington—Pre-season scramble for Miami tourists has brought a battle between competing Miami Beach hotel chains before the CAB.

Shower of Stars Hotels, representing the Algiers, Delano, Montmartre, Barcelona, Monte Carlo, DeLido, Caribbean Shore Club, Shelbourne, Sea Gull, Sea Isle and Sorrento hotels has filed a formal complaint with the Board against Trans-International Airlines, Nationwide Charters and Conventions and Morris Lansburgh as owner of the Saxony, Crown, Versailles, Sans Souci and Casablanca hotels.

Basis for the complaint is that Lansburgh, along with the supplemental airline and the charter agency, has been offering illegal airline charters using the names of the B'nai B'rith and the National Amateur Golfers Assn. as sponsors for special, low-fare round-trip charters. The price being advertised in Boston and New York papers for a 15-day round-trip tour amounts to only $259 for all expenses, the complaint contends.

Prime grounds for the Shower of Stars Hotels' request for a CAB investigation of the offer is an allegation that persons interested in the tours need not be members of the organizations, as required by CAB charter regulations, but can join for as little as $5 and qualify for the low-cost tour as explained by follow-up telephone inquiries to Nationwide Charters.

Rather than being legal charter flights, the complaint contends, the entire tour offering is a matter of individually ticketed flights for which the airline is not certificated.

Since the tour advertisements began, the program has expanded to include such other organizations as the Knights of Pythias, the Women ORT and "Civil Service Associations." Interested parties who have responded as a result of these later advertisements have been told they do not have to be a member of these organizations as long as tickets are purchased by a member of the organization, the complaint stated.

Claiming that the advertising campaign has damaged their own business and that of many travel agents, the Shower of Stars Hotels asked that the CAB hold a hearing on the complaint before the end of this week.

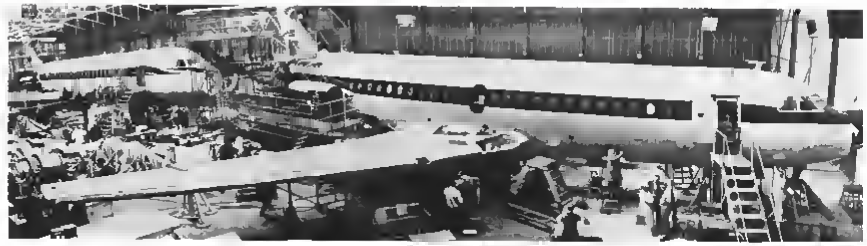
In an amended complaint last week, Shower of Stars further charged that Samuel Cohen, owner of the Saxony, Deauville, Sherry Frontenac and Crown hotels with whom Lansburgh has a management contract, has purchased controlling interest in Trans-International Airlines without first seeking CAB approval.

CAN YOU PASS THIS AIR TRAVEL QUIZ?

(ANSWERS AT LOWER RIGHT)

1. Which airline has the world's largest jet fleet?
   UNITED ☐ TWA ☐ AMERICAN ☐
2. Which airline serves the most U.S. cities by jet?
   UNITED ☐ TWA ☐ AMERICAN ☐
3. Which airline operates the only commercial jet ever to fly faster than the speed of sound . . . the DC-8?
   UNITED ☐ TWA ☐ AMERICAN ☐
4. Which airline offers flights with a single class of service that combines a first class feeling with a close-to-coach price?
   UNITED ☐ TWA ☐ AMERICAN ☐
5. Which airline flies the quietest jet in the world, the Caravelle?
   UNITED ☐ TWA ☐ AMERICAN ☐
6. Which airline was the first to take delivery of the tri-jet Boeing 727, the newest airliner in the world?
   UNITED ☐ TWA ☐ AMERICAN ☐
7. Which airline operates the most complete variety of jets?
   UNITED ☐ TWA ☐ AMERICAN ☐
8. Which airline flies the jet that holds the long-distance record for nonstop flight, the DC-8?
   UNITED ☐ TWA ☐ AMERICAN ☐
9. Which airline offers the most jet service throughout the nation?
   UNITED ☐ TWA ☐ AMERICAN ☐
10. Which airline serves the most U.S. vacation areas, including Hawaii?
    UNITED ☐ TWA ☐ AMERICAN ☐
11. Which airline is chosen by more people than any other airline in the world?
    UNITED ☐ TWA ☐ AMERICAN ☐

{Answer to questions 1 through 11: United Air Lines.}



First BAC 111 Production Models Shown

First production models of British Aircraft Corp's BAC 111 short-haul jet transport are shown in the line at BAC's Hurn, England, facility. Four of the first five aircraft are scheduled for delivery to British United Airways and one to Braniff International Airways. First flight of the No. 2 BAC 111 is planned this week from the Hurn plant. The second aircraft, first of the BUA batch, will incorporate some modifications specified after the crash last October of the prototype (AW Nov. 11, p. 45). These changes include installation of a tail parachute to be used when stall tests are resumed.

Congress, CAB Eye Riddle Operations

By Robert H. Cook

Washington—Riddle Airlines' reorganization problems under a new management team may force a closer scrutiny of the cargo carrier's operations by both Congress and the Civil Aeronautics Board, prodded by the continuing complaints of major stockholders.

Congressional concern centers mainly about the political implications of a special Riddle flight that carried influential congressmen and staff members between Washington and Las Vegas to attend an April fund-raising dinner for Sen. Howard W. Cannon (D.-Nev.), a member of the Senate Armed Services Committee.

CAB began an investigation of the flight as a result of a Senate probe into the activities of Robert G. Baker, former secretary of the Senate Majority. While still in his post, Baker was presented with a $16,000 bill for the flight by Washington Columnist Jack Anderson, a member of the Riddle board of directors. Anderson was elected to the Board earlier to "improve the corporate image" of the cargo carrier, according to Chairman James H. Carmichael.

At a November stockholders' meeting, Riddle added Steve Lee to the list of directors. He was well known in top-level military circles as director of information for the Air Force when Sen. Stuart Symington (D.-Mo.) was Air Force secretary.

Military Contracts

Riddle has been forced to abandon most of its common carriage service because of financial problems, and is almost solely dependent upon military contracts awarded by the Military Air Transport Service.

CAB enforcement attorneys have completed their investigation into the Las Vegas flight. If the airline is found guilty of violating Board regulations prohibiting free transportation, it could be fined. Even if it is not, the implications of an attempt to influence congressional members could spur Congress to probe deeper into the affair. The Senate Rules and Administration Committee, investigating Baker's activities, was reported ready to demand that CAB release a passenger list of the flight last week. Riddle submitted a westbound passenger manifest to CAB, but contends that a manifest for the return flight has been lost.

Financial Difficulties

Last year Riddle was forced to drop three MATS contracts because of its financial difficulties, but one month after the Las Vegas flight, the Small Business Administration awarded the airline a certificate attesting to Riddle's competence to bid upon and carry out military contracts. The following month, Riddle was awarded 1964 military contracts of $4.7 million for MATS and $3.9 million for Logair domestic military traffic.

While the airline may be absolved of any violation charge arising from the flight, some CAB sources feel that the intense publicity given Riddle's problems may force a further investigation of the airline's financial reorganization, involving the holding of one million shares of common stock in the company by General Dynamics. Several similar arrangements have been rejected by the Board in the past on grounds that they constituted a degree of control over the carrier by another firm.

Riddle spokesmen say they are not free to discuss any aspect of the Las Vegas flight, since it is under investigation by the CAB.

Control Fight

"However, we are aware that there is a group which is attempting to wrest control of the company from the present management," they said, "and in the interest of the stockholders we shall do everything possible to assure that this effort is unsuccessful."

Robert Hewitt, former president of the airline, and James S. Price, two of the largest stockholders, are leading the ouster attempt.

Hewitt holds 1.5 million shares in the company and became president in 1959 after his own business consultant firm recommended changes in Riddle management. The airline's revenues increased from $6 million to $29 million during the first two years under his management, Hewitt contends. Then, the company experienced operational problems with its fleet of six HS Argosy cargo aircraft. Several were grounded, forcing the airline to transfer several of its fleet of 10 DC-7 aircraft from highly profitable transatlantic operations to fill the void created by withdrawal of the British-built aircraft from domestic Logair operations.

Early in 1962, the company began to formulate a new financial program and to strengthen management. In line with the plan, Riddle hired James B. Franklin in August as executive vice president of maintenance and operations. Franklin served for 10 years as

a vice president of Capital Airlines, while Carmichael was Capital's president and later board chairman.

In the belief that it would accelerate Riddle's financing plans, Hewitt said he first agreed to replace several members of the board of directors. On the same premise, he said, he was forced to resign as president on Sept. 29 and was replaced by Franklin. Carmichael, who had been a director, became chairman of the board. Hewitt remained as a director until March of the following year, but agreed to place his 1.5 million shares of stock into a voting trust.

Before the end of the year, a Riddle agreement to purchase two Boeing 707 cargo aircraft was canceled in favor of a lease-purchase arrangement with Douglas Aircraft Co. Part of the agreement covered a refinancing of more than $8.2 million owed to General Dynamics on the DC-7 fleet and to Douglas for conversion work. As an extra provision, Douglas insisted on retention of the new management team.

General Dynamics wrote off $2.2 million of the debt refinanced, $6.2 million and accepted one million shares of Riddle stock as part of the agreement. The stock was placed in a voting trust to be voted by the Riddle management.

As part of the general refinancing program, Hewitt had already agreed to place his stock holdings in a voting trust. In the annual stockholders' meeting last month, Carmichael stated he had proxies for nearly half of Riddle's 15 million shares—among them the 2.5 million shares held by Hewitt and General Dynamics—plus an additional one million shares placed in a voting trust by William Price, insurance broker for the company.

Hewitt's request to withhold the voting of his stock was rejected. The current slate of top officers were re-elected and the only major decision made at the stormy session was changing the company's name to Airlift International Inc. Hewitt is now in the process of registering his stock for sale with the Securities & Exchange Commission. Once registration is accomplished, he may have the legal right to vote the stock, some attorneys believe.

James S. Price, one of the most outspoken of the stockholders objecting to Riddle's management, has attacked the role of his brother William in the reorganization move. William Price submitted a $50,000 bill to the airline last summer for expenses incurred while helping in the reorganization last year. The bill, which lists items incurred at expensive resort areas, covers a nine-month period before Franklin assumed control, plus the remainder of the year.

Carmichael received $1,500 a month as a business consultant for the airline, and James Price has questioned why it was settled for $35,000 about 20 months after the work was accomplished. Riddle stock, which sold around $1 a share during the Hewitt regime, has dropped as low as 30 cents per share, Price contends. Company revenues, which hit $29 million in 1962, fell to $17.4 million for the year ended June 30, 1963.

Price has threatened to sue the Riddle management if he is unsuccessful in unseating them. While the company has been losing steadily, he notes, high salaries and generous contracts have been voted for both Franklin and Carmichael. Franklin is paid $50,000 per year on a five-year contract, which would guarantee payment to his survivors through the life of the agreement. Carmichael was voted a $25,000 annual salary, plus additional expenses and remuneration for any special duties he might undertake as a business consultant. Under this formula, he derived $35,000 for 'part time work' last year, Price contends.

In addition to the salaries, both men have been given stock options—500,000 shares for Franklin and 200,000 for Carmichael—at 30 cents per share, he added. Company records indicate the two officers currently hold less than 100 shares in the company. However, their control over stock held in voting trusts exceed 4 million shares, he said.

Fare Opinions Sought

New York—American Airlines, answering cities of its proposed reductions in first-class and family fares, has suggested that the Civil Aeronautics Board let each transcontinental airline initiate its own fare adjustment scheme and permit the public to judge which is best.

American thus withheld criticism of the three-class proposal of Trans World Airlines (AW Dec. 9, p. 39) and the single-class family plan discounts advocated by United Air Lines. It termed as "patently ridiculous" charges by other carriers that American's fare reduction plan will harm the industry financially.

The American proposal is to reduce by 5.15% the existing first class fare on flights over 700 mi., and to provide 25% discounts in both first class and coach for dependents flying with family heads (AW Dec. 2, p. 47).

American's estimates show that 80% of present first-class family plan traffic will switch to coach with the extension of family fares to that section. For the 20% that remains in first class, the combined fare will be only $1.24 more for both family members.

The proposal also would bring the first-class fare to within $15.80 of coach fares on transcontinental flights, American officials said.

Government Ponders KLM Board Shuffle

By Cecil Brownlow

Geneva—Dutch government is considering a general realignment of KLM Royal Dutch Airlines' board of directors in the immediate future in a continuing effort to heal the rifts that have developed within the top management structure and the resultant discord among the employes.

An initial step in this direction would be the anticipated resignation of the 72 year-old chairman, Dr Frans den Hollander, as a sequel to the planned departure on Jan. 1 of executive vice president and acting general manager E. H. Larive after a controversial 12 month tenure in the post.

Larive, who had tended to support the KLM Pilots Assn. in its now-disrupted contract negotiations with the carriers, has resigned rather than accept a government-imposed curtailment in authority.

Lower level management changes are now being made and still more are expected as the government, which controls 68% of the carrier's stock, and the airline attempt to settle the lingering internal disputes that recently spurred the pilots association to announce that it has lost confidence in management (AW Nov. 25, p. 41).

Final impetus behind the move apparently stemmed from the carrier's determination to stand by its plan to trim the present force of approximately 700 pilots to roughly 500 as part of the long-planned reorganization of the overall structure of the airline. Larive reportedly had indicated that he would cut down on the number of pilot dismissals despite the opposition to any such move on the part of the other three managing directors.

A spokesman for the pilots association said last week, however, that there is no one particular issue behind its "no confidence" vote and that it stems primarily from a general feeling of unrest and disillusionment with the steps being taken to reorient KLM to meet its needs and possibilities. He added:

"The flight personnel generally expect some sense of direction. We have had a reorganization promised but very little seems to be happening."

The no-confidence motion, he said, also has the backing of the three other KLM unions representing flight personnel—one each for the flight engineers, stewards and hostesses—as well as from the higher salaried staff association drawing its membership from both ground and flying personnel. The latter group, however, has no negotiating rights with the company as such.

Following the pilots' denouncement the government intervened openly, instructing A. H. C. Gieben, former secretary general of the Ministry of Transport and the government's representative on the KLM board, to seek some means of negotiating a truce within the airline's governing body and between the management and dissident employes.

A pilot spokesman told AVIATION WEEK & SPACE TECHNOLOGY that this had led to some hope on the part of the flight personnel that some stability might be achieved within the corporate structure. He added that, with Larive's announced departure, the situation remains fluid and there appears to be no point in negotiating when it is not known whether any agreements could or would remain.

The pilot spokesman said the flight personnel plan to maintain a wait-and-see attitude, taking no direct action until they feel that the management has become stable. The group's earlier negotiations came to an end when the no-confidence vote was made public.

KLM has said that it is willing to resume negotiations after the pilots indicate a willingness for such a move.

Under present planning, Larive will not be replaced. Other executive shifts have been made quietly, and the top echelon now includes Hora Alberda, a former banker, as president, John van der Wal as deputy president, and Frits Besancon as executive vice president. Besancon was deputy president under former president E. H. van der Beugel, who resigned last January when the management reorganization began. At that time the directorate was trimmed from six men to four (AW Jan. 21, p. 41). Besancon is the only member of the present management structure who has served the airline in a top position for any length of time.

Larive, who came to KLM at the time of van der Beugel's departure, will return to his former post as managing director of Shell Tankers, Rotterdam.

Alberda, in announcing Larive's resignation at KLM headquarters at The Hague, said the move had become necessary since fruitful cooperation within the management was no longer possible and urgently needed cooperation and unity of action had become increasingly difficult. He described relations between the three remaining managing directors as very good.

Over-all reorganization of the airline, generally following the recommendations of McKinsey and Co., Inc., a New York management firm called in last year after a series of financial reverses, apparently still will be carried out to a large degree.

Some spokesmen report that the government's primary reason behind the decision leading to Larive's departure and the expected resignation of den Hollander, stemmed primarily from their reported open door policy of meeting with dissident groups within the company rather than insisting that they go through normal channels.

Larive reportedly had been offered the opportunity of remaining as executive vice president of the airline, but only if he stepped down from his position as acting general manager.

Den Hollander, as chairman of the board, had presided over the management meetings for the first six months after van der Beugel's resignation but had no operational authority as such. This fall, Alberda took over the task of presiding at the management sessions.

Meanwhile, KLM has concluded agreements with the three trade unions representing the approximately 9,000 ground personnel calling for an across-the-board 10% raise effective Jan. 1 plus a minimum wage of about $28 per week for male employes by age 25.

The agreement has been interpreted by some as evidence of a widening dispute between the flight and ground personnel during the current clash. Such a trend is denied, however, by a pilot spokesman who says his association took no position.

United Caravelles

New York—United Air Lines has told prospective buyers that its 20 Sud Caravelle jet transports will be available at a reduced price as the airline takes delivery of its Boeing 727 medium-range jets.

G. R. McGregor, president of Trans Canada Airlines, said at Ottawa recently that United called him about the Caravelles before Trans Canada decided to buy the Douglas DC-9 for its short-haul requirements. United feels it is nearing the end of the interim period in which the Caravelles were used to establish a 727 market (AW Apr. 15, p. 45).

McGregor's choice of the DC-9 over a purchase of Caravelles directly from Sud Aviation was basis for a renewed attack against the government-owned airline from French-Canadian representation within the Parliament. McGregor's critics charged that he discriminated against the French by his selection, and that he should be dismissed as Trans Canada's president.

SHORTLINES

► **American Society of Travel Agents** has warned International Air Transport Assn. carriers that failure to reach an agreement on transatlantic fares has forced travel agents to delay promotional activities for the forthcoming season, which could result in depressed load factors.

► **British West Indian Airways** has opened sales offices in Dallas, to cover the southern states region, and in Toronto, to cover eastern Canada.

► **Civil Aeronautics Board** last week denied petitions for reconsideration of its order disapproving a block space agreement under which Japan Air Lines would lease space on all-cargo jet flights operated by Pan American World Airways between San Francisco and Tokyo.

► **Continental Air Lines** flew an estimated 90 million revenue passenger miles in November, a 22% gain over the 73.6 million flown in the same month last year.

► **De Havilland Aircraft of Canada, Ltd.** will begin assembly of Douglas DC-9 sub-structures, wings, fuselage rear section and entire tail assembly in January at its Toronto plant. Production sharing contract with Douglas Aircraft Co. will produce an estimated $65 million in revenues for de Havilland.

► **Eastern Air Lines** has named two advertising agencies to handle its accounts. Benton & Bowles will handle primary advertising including newspapers, radio and television. Gavnor & Ducas will concentrate on direct mail, cargo sales, special promotions and new projects.

► **Irish International Airlines** claims to have attained the highest load factor of all IATA carriers on the North Atlantic in each of the six months between May and October. Carrier's eastbound load factor in October was 53% and westbound, 77.9%.

► **Panagra** will again fly over one ton of toys to Panama, Ecuador, Peru, Bolivia, Chile and Argentina from the U.S. and distribute them at orphanages and hospitals. The Panagra toy lift was inaugurated in 1954 and has been conducted voluntarily by the airline every year since.

► **United Air Lines** carried 1,080,500 passengers in November, a 9.6% increase over the same month last year. It was the ninth straight month that the airline carried over 1 million passengers.

AIRLINE OBSERVER

► International Air Transport Assn. has reported a 6.1% increase in the number of passengers carried across the North Atlantic in scheduled operations for the first 10 months of 1963, compared with the same period last year. Number of economy passengers carried during the period rose 7.6% while first class volume dipped 9.1%. Total seating capacity for the 18 carriers climbed 12% to depress load factor to 50%, a 2.8% decline from the level reached during the first nine months of 1962. First-class load factor for the 1963 period was 29.9% and economy load factor was 53.2%.

► **Bilateral air transport agreements will be used by Russia and Red China as steps toward expanding trade opportunities, particularly in the Near East and Africa. Pakistan's ties with both countries have been strengthened by bilateral agreements (AW Oct. 21, p. 43), and Russia has emphasized that the Moscow-Karachi air link will serve as a forerunner of Pakistan-Soviet collaboration in other areas. Last week, the Russians opened talks with Algeria on a bilateral agreement.**

► Federal Aviation Agency is expanding its financial support of the DC-3 replacement design program to include a detailed economic analysis of the chosen design. In addition to the $300,000 that FAA will pay for three designs under current requests for proposals, the agency has invited several economic consulting firms to enter competitive bids for the study. Budget for this purpose will be limited to $100,000, FAA sources said.

► **British Overseas Airways Corp. maintenance department, still smarting from charges of excessive costs made by Air Minister Julian Amery in his White Paper on the airline's financial standing (AW Dec. 2, p. 39), last week said it is entering another stage in its cost reduction program, started in 1957. Chief Engineer Charles Abell said plans now in hand should save another $5.6 million annually, and noted in a message to his staff that the White Paper "did not do justice to efforts we have made over the last five years."**

► Civil Aeronautics Board, in a 4-1 vote, denied a Delta Air Lines application to provide single-plane service between Huntsville and Dallas and Los Angeles. Delta held that the service was necessary to accommodate personnel participating in space and missile activities, but the Board concluded that approval of the application would not contribute to "the development of a sound air transportation system." Member Chan Gurney dissented, stating he would certificate the carrier "in the interests of our national defense and space efforts."

► **British European Airways crew training staff has surrendered to British winter weather and moved its entire operation from Stansted, Essex, to Malta. BEA estimates it can train 29 Vickers Vanguard captains and four first officers at Malta by next April, at Stansted, the program would have taken until June.**

► Air Transport Assn. board of directors last week authorized formation of a committee of airline presidents to study local service problems and develop a program for the promotion of local service operations. Committee will represent all segments of the air transport industry. At the same time, the directors authorized a 9% increase in ATA's 1964 budget and approved a $200,000 expenditure for the promotion and advertising of air travel cards.

► **In a major step toward diversification, Frontier Airlines is planning to construct a $60-million chain of motels throughout its system. Five-year project will begin in February. Motels will be designed according to historic architecture of various areas served by Frontier.**

► No recommendations on the financing of the U.S. supersonic transport are expected from Eugene Black until about mid-February. Black was named by the White House to make a special study of financial problems embracing the supersonic transport program (AW Aug. 26, p. 25).

► **French government has authorized Sud Aviation to increase its Caravelle production planning from 200 to 225 aircraft. Additional 25 will be type 10B, powered by Pratt & Whitney JT8D-1 turbofan engines. To date, only order for the Caravelle 10B has been placed by Finnair, for six aircraft.**

This is Lockheed's first advertisement on the supersonic transport. You'll be seeing it this month in the WALL STREET JOURNAL and newsweekly magazines. Its purpose: to capture the attention of the ultimate consumer — the traveling public. In artwork and headline we dramatize speed — the basic airline commodity — by showing that the supersonic transport will outdistance the sun on westbound flights.

The plane in the artwork looks a bit dated, doesn't it? That's because it's based on an actual model we tested in our wind tunnel back in 1959. You know, of course, that we have been working steadily for several years to evolve an optimum configuration. We will submit it in January to the government and the airlines as our proposal for the United States Supersonic Transport. It's a good deal different from the plane in this advertisement. We hope to show it to you soon after January 15.

LOCKHEED-CALIFORNIA COMPANY
A Division of Lockheed Aircraft Corporation
Burbank, California

Study Reports 'Acute Shortage' Of Experienced Air Controllers

Geneva—Present "acute shortage of qualified air traffic controllers everywhere," prolonged work periods, poor environments and the growing need for additional centers in the underdeveloped areas of the world are emphasized in a report issued here by the United Nations' International Labor Organization. The report was based on a six-month survey of facilities and conditions in the Americas, Europe, Africa and the Middle and Far East.

It warned that the controller is facing more problems despite a slow trend towards automation because of the steady traffic growth, increased flying speeds, extension of the controlled airspace areas and the development of further inter-city and inter-terminal helicopter operations.

Written by Dr. Jacob Schenkman, director of research at New York's International Transport Institute, it said in part:

"At the present time there is an acute shortage of qualified controllers everywhere. In the developing countries this shortage is particularly serious. Where the level of general education would normally make it possible to find eligible trainees, the basic reason for difficulties in recruitment lies very largely in the relatively unattractive conditions of employment which prevail almost everywhere in this profession."

Report Conclusion

In conclusion, the report "hoped that action will be taken by the [respective government] authorities ... to improve the general conditions of employment for air traffic controllers ..."

A meeting to consider recommendations for standardization and improvements in air traffic control operations does not appear to be in the immediate offing, however. A spokesman for the labor organization said there are no funds in the 1965 budget requests—due to be approved in February—for the convening of its ad hoc civil aviation committee, which last met in 1960. That committee normally would consider such matters.

Copies of the report will be distributed to the 108 member nations, however. If sufficient interest is shown, the committee could be convened at a later date.

Hours and conditions of work for the controllers vary widely, according to the report, with personnel in some countries working a 12-hour day without interruption. In those areas, the report said "reasons given most frequently are the shortage of qualified personnel and the absence of adequate transport facilities at suitable times. It is indicated that in some cases the time required for a one-way trip from home to work amounts to one or one and a half hours." Countries that have adopted the 12-hr. work day for controllers include Austria, France and Malaya.

The survey also warned that "in work of this type, shifts of the order of 12 consecutive hours give cause for anxiety. The reorganization of hours of work and shift schedules to allow for better rest breaks would also appear to be called for, especially in the form of minimum periods of rest before assuming duty."

Work Breaks

On-the-job work breaks appear to be far from standard procedure, although the controllers, by the nature of their jobs, are compelled to work under a certain amount of nervous strain. The survey reported:

"In Malaya, controllers work without break for meal or rest during a whole day's or night's shift lasting for 12 consecutive hours. The Nigerian government has indicated that it is impossible due to the staff situation at present to arrange any break during a watch for the air traffic control officer; however, it is hoped that when the required establishment is obtained, watch supervisors will be available as reliefs during watches to allow each air traffic control officer a break."

"The Australian government has indicated that no provision is made for meal breaks in that country since meals are taken on duty during slack periods."

Informal Arrangements

"In the many countries where break and relief periods during the duty time are not officially provided at all, or are very brief, amounting in certain cases to 10 minutes, this shortcoming is being overcome through on-the-spot arrangements between the controllers themselves. Such practices are certainly far from satisfactory."

A controller's work week ranges from a low of 40 to a high of 48 hr. The U.S. and Australia have adopted the lower figure. In France, the work week ranges from 40 to 45 hr. depending upon the location of the tower, while the United Kingdom has a 42-to-44 hr. pattern. The high of 48 hr. per week is in force in the Congo (Brazaville) and Malaya.

The report noted that the U.S. Air Traffic Control Assn. recommends a daily six-hour tour of duty for a weekly

Who says all females are alike?

All females are supposed to be unpredictable, unreliable, and hard to handle.

Here's one that isn't. It's the "better half" of Amphenol's new Ultra-Mate* connector.

GO/NO-GO RELIABILITY

The Ultra-Mate connector is more than predictable. You can bet your life on it—which is exactly what astronauts do each time they soar away from the launch pad. Ultra-Mate will mate *only* if every pin fits snugly into every socket. No mis-connection intermittencies.

EASY TO HANDLE, TOO

Ultra-Mate gets its go/no-go reliability from the female half's hard-faced closed entry receptacle. Ultra-Mate is the only truly environmental, space age connector that combines a hard dielectric with *front* servicing. Any stubby-fingered technician can assemble or disassemble an Ultra-Mate connector in mere seconds.

How did we do it?

Take a close look at the female Ultra-Mate. You'll see 55 funnel-shaped openings, one for each contact. These hard-dielectric entryways guide contact-pins smoothly into their sockets. Like Figure 1 at the right. If pins are bent out of line, the connector halves just won't mate.

Now, look a little closer. See those tiny slots fanning out of each entryway? These are the secret of Ultra-Mate's front release system.

Only the standard removal tool will fit into these slots. No wrong-size contacts. No oversize test prods. Ultra-Mate is idiot-proof. And it's fast. Contact positions are clearly marked in front of the dielectric.

MIL-C-26500 PERFORMANCE

For the first time, an environmental connector combines tamper-proof safety and service features with MIL-C-26500 performance. Ultra-Mate also meets the requirements of MIL-C-38300, a recently issued Air Force specification that retains the rigid environmental and temperature standards of MIL-C-26500, but specifies either a hard closed entry or soft dielectric. It also employs, as does MIL-C-26500, front removal of contacts and incorporates new reliability requirements never included in connector specifications to date.

Here's what you get with a fully pressurized Ultra-Mate connector:

1. Operates continuously with current load at 200°C ambient.
2. Undamaged by 50 g's shock.
3. Withstands thermal shock, 5 cycles between −55°C and +260°C.
4. Carries 1 500 volts RMS submerged in salt water while pressure is alternated between sea level and 75,000 ft. altitude equivalents.
5. Handles 1 000 volts RMS at altitudes up to 110 000 feet.
6. Insulation resistance exceeds 5 000 megohms.
7. Unaffected by exposure to hydraulic fluid, lubricating oil, ozone and moisture.

ULTRA-MATE AVAILABILITY

You can specify Ultra-Mate connectors now in all basic sizes referenced in MIL-C-26500. Bayonet or threaded couplings. Any Amphenol Sales Engineer can give you the complete specs and engineering data. Or, write to Dick Hall, Vice-President, Marketing, Amphenol, 1830 S. 54th Avenue, Chicago 50, Illinois.

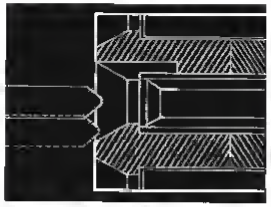


Figure 1. Slight misalignment is self-corrected by the beveled entry of the Ultra-Mate connector. Badly bent pins will prevent mating until they are replaced.

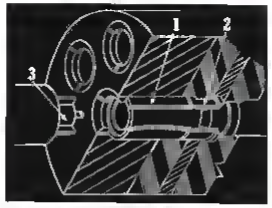


Figure 2. Standard removal tool depresses activation sleeve (1) which spreads tangs of retention clip (2) apart. Tool (3) never directly touches clip.

*Ultra-Mate is a Trademark of Amphenol-Borg Electronics Corporation

Amphenol A DIVISION OF AMPHENOL-BORG ELECTRONICS CORPORATION

total of 30 hr rather than the present eight-hour day because "the constant exposure of the controller to the conditions prevailing in complex high-density facilities has created a safety problem and [illegible] this fact is reflected in the critical physical and mental impact on the controller and the mounting tensions and pressures that have been building up in these facilities," the report said.

Another subject under dispute is the time a controller should spend monitoring radar. In some countries, this is restricted to two hours without interruption but in others the report said, controllers spend a full day before the radar screen without a break despite the nervous and visual strains involved. It added:

"Considerable concern has been expressed that with the extension of radar control the practice of prolonged work at radar screens which is now exceptional will become the rule with adverse effects on the health of controllers and consequently on standards of safety in air navigation."

Ansett-ANA Buying S-61N to Serve Island

New York—Sikorsky S-61N helicopter is being purchased by Ansett-ANA for tourist service between Australia's Queensland coast and Hayman Island, a resort site, which is located on the Barrier Reef.

Ansett ANA has made a deposit toward the full purchase price of $900,000, which includes spare parts. Delivery of the helicopter is scheduled next May with service to begin in June. The 27-passenger aircraft's hull is sealed to provide an emergency water landing capability.

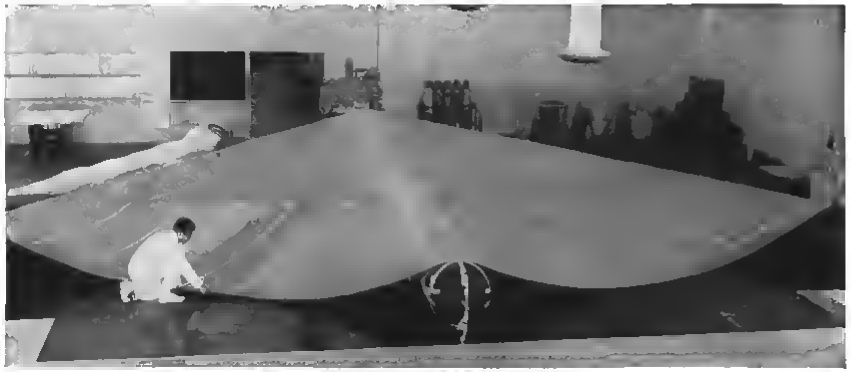
Ansett ANA is part of an organization which owns several hotels on Hayman.

The airline has provided air service to it from Australia for several years, using amphibious fixed wing aircraft.

The carrier is also expected to ask the Australian government soon for authorization to purchase a third Boeing 727.

It will cite a 12% increase in domestic passenger volumes this year as basis for buying the jet.

The government, however, is interested in maintaining an equal competitive relationship between Ansett ANA and the country's other domestic carrier, Trans Australian Airlines. Both carriers currently have two 727s on order, and Ansett ANA's request for a third, officials said, may possibly be denied unless Trans Australia has equal need for a third jet.



GEMINI PARAGLIDER wing is stretched on table before packing. Basic wing framework is in six subsections, with 600 sq ft. sail area.

Five-Month Test of Gemini Paraglider

By C. M. Plattner

Los Angeles—An intensive five-month flight test program of full-scale prototype Gemini paraglider recovery system will begin this month at Edwards AFB.

The test program, including pilot-controlled vehicles used to evaluate landing techniques, is intended to pave the way for development of an operational paraglider system for eventual use in Project Gemini.

The test program, which will be conducted by North American Aviation's Space and Information Systems Div. has been split into two phases involving two types of vehicles. One, a tow test vehicle incorporating a complete paraglider control system will be pilot controlled during glide and landing. It will be towed to altitude by a helicopter and released.

The other type, an unmanned full scale test vehicle, will be used to check paraglider deployment after being air-dropped from a cargo aircraft. Two tow test vehicles and two full scale test vehicles are being manufactured by North American for delivery to Edwards for use in the test program.

The recent award of a $20-million definitive contract from the National Aeronautics and Space Administration's Manned Spacecraft Center to underwrite the development and test program reflects a confidence and determination within NASA that a workable paraglider recovery system can eventually be developed for Gemini.

At what point a paraglider will be used in the current 12 vehicle Gemini program is still uncertain (AW Oct. 21, p. 29) but the outcome of the test program at Edwards is expected to establish a realistic estimate of when a production system can be developed and qualified. With good success in the prototype program, a production paraglider probably could be available by the fall of 1965.

A parallel recovery system employing a single parachute for water landings is under development by Northrop Ventura (AW Sept. 16, p. 69) and will be used on the first Gemini shots. Northrop now has a contract to provide five recovery systems which could be used to recover vehicles two through six.

The advantage of a paraglider system for Gemini is that recovery after reentry may be accomplished on land—at a suitable airfield within the landing footprint.

In the tow vehicle test program, the vehicle will be taken to 12,000 ft. MSL by a Vertol CH-46A and piloted to a landing. The tow vehicle resembles a Gemini spacecraft in outward configuration, but has large, flush twin plexiglass canopies and wheel rather than skid-type landing gear. The interior also matches Gemini, but only instruments required for testing the paraglider will be installed.

During gliding flight, the paraglider wing system will only provide pitch and roll control, by lengthening or shortening the suspension cables. The nose cable length remains fixed. Suspension is provided by the nose cable and two integral cables, wrapped around a winch near the midpoint with the four ends attached to the wing. The longitudinal control cable is attached to a keel catenary curtain, the roll control cable is attached to two boom catenary curtains.

Nose-down longitudinal attitude is controlled by reeling out the aft pitch cable and shortening the diagonal pitch cable. Displacement of the cables, in effect, changes the relative position of the vehicle and the sail by translating the sail aft along a parabolic arc.

Consequently, the center of gravity is moved forward and the wing assumes a more nose-down attitude. This results in increased velocity and sink rate after the wing is stabilized in its new position at a smaller angle of incidence—which is the angle between the center line of the vehicle and the keel line of the wing.

Pitch up is accomplished by shortening the aft pitch cable to position the vehicle more toward the rear, relative to the wing, and at an increased angle of incidence. The total pitch range in terms of angle of attack is from 20 to 50 deg. with a leveling off in lifting efficiency at angles greater than 40 deg. At about 16 deg. angle of attack the sail becomes partially unfilled and at even lower angles, sail flutter occurs.

The tow test vehicle is rolled in much the same manner, by changing the relative position of the wing along a parabolic arc perpendicular to the line of flight. Angles of bank up to 30 deg. or greater are possible, but bank angles of 20 deg. will probably be adequate for most maneuvers. A turning radius of roughly 500 ft. is hoped for in present flight profiles.

Although there is no means of controlling yaw, it is not expected that this will be a problem. Previous tests have indicated that yaw motion will be small with directional stability supplied by the conical sail lobes.

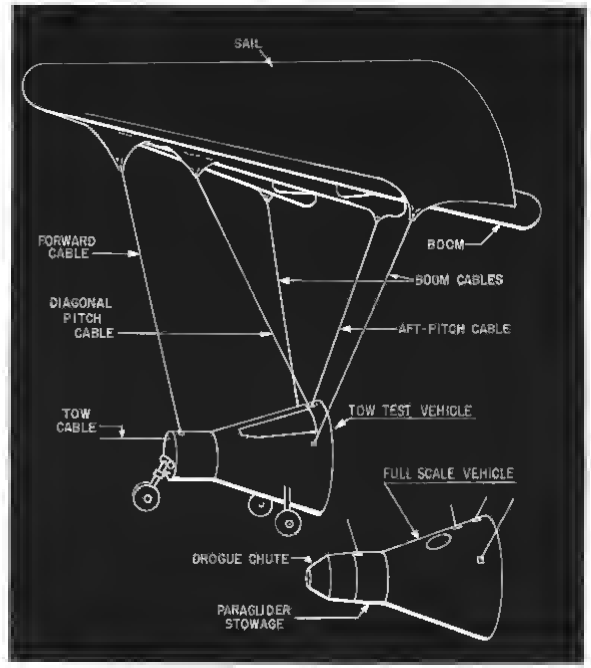
During the helicopter-towed takeoff with the fully-inflated paraglider, ballast will be attached to the aft end of the keel to insure proper angle of attack during the first part of the takeoff roll. After the wing is stabilized, the ballast will be jettisoned. This technique was developed in the half-scale tow tests at Edwards last summer.

For the first part of the takeoff run, suspension lines are snubbed up so that the wing rides atop the vehicle. Release of the snubbing straps deploys the wing at 20 to 25 kt. Ballast is released a short time later. Liftoff in a trimmed maximum L/D condition will be about 50 kt. after 1,000 ft. of ground roll. Tow to altitude will be at 45 kt.

Subsequent glide speed after release at 12,000 ft. will be from 40 to 60 kt. IAS. During gliding flight, the tow test vehicle is expected to be no more difficult to control than a conventional jet aircraft. Nominal control response rate is expected to be on the order of 0.5 sec. from movement of the sidearm control stick through repositioning of the wing. The pneumatically-driven

APEX SUBASSEMBLY SECTION OF WING frame (above, left). Wing section is put into autoclave (above, right) for curing process.

Paves Way for Operational Development



TWO TYPES OF VEHICLES IN EDWARDS flight test program are shown above. Tow test vehicle, under paraglider will be pilot controlled. Full scale model will be unmanned.

winches will reel the cables at a rate of 9 m per sec

The flight control system is a proportional type, yielding control cable displacements corresponding to amount of movement of the sidearm controller Signal from the sidearm control stick is transmitted electrically to the nitrogen gas motors which drive the winches Both rate of rotation of the winch and actual displacement are monitored and fed back into the system to neutralize input signals.

Most difficult portion of the manned paraglider operation will be the final approach and landing With a maximum over-all L/D of roughly 3½, landing the vehicle is expected to approximate in difficulty a flameout landing in a high performance, swept wing jet aircraft. Such a landing requires extensive pilot training so there is a minimum sink rate

Increase Airspeed

If a flare technique is used, starting too high can result in mushing in with a high sink rate when increasing angles of attack yield more drag than lift Flaring too low could also result in a high sink rate at touchdown because available lift may not be sufficient to counteract the high sink rate

One projected paraglider landing technique, refined in analog simulator studies, would be to increase airspeed prior to flaring by diving the vehicle The pilot would commence a pre-flare glide at approximately 400 ft or above and increase airspeed by 55 to 60 kt The paraglider would be pre-trimmed to the optimum angle of attack desired for flare Forward stick pressure applied during the pre-flare glide would hold the higher airspeed

Slow Sink Rate

At a nominal flare altitude of 50 to 100 ft., the stick would be neutralized to the pre-trimmed position to slow the sink rate from between 25 to 30 fps, to less than 10 fps at touchdown The pilot would continue to pull the stick back, increasing the angle of attack until touchdown at 40 to 45 kt

Approaching the flare at airspeeds close to 60 kt gives the greatest possible flare-initiation altitude band, allowing more room for error in altitude judgment The actual landing technique employed will be determined by the pilots during the flight test program.

Although the maximum L/D ratio of the wing itself is around 4½, the over-all glide ratio drops to a maximum of 3½ when the tow test vehicle is slung underneath Formerly, the maximum L/D ratio of the wing was approximately 3½ but this was increased by flattening the sail lobes (AW July 22, p 189) to make the paraglider easier to land In gliding flight at an L/D of 3½, the angle of attack is approximately 35 deg at an indicated airspeed of 50 kt with a sink rate of 21 to 23 fps

The tow test vehicle, which will be flown initially by North American test pilots, is the first full scale vehicle in the Gemini paraglider development program to be pilot controlled Additional features of the tow test vehicle include

• **Rocket-assisted Weber ejection** seat which may be fired through the canopy If an ejection situation arises, the wing will be cut loose by actuating cable cutters which will slice through the five suspension cables and the emergency air supply hose, which replenishes the wing in event of a leak This will allow the wing to drop back out of the line of fire of the seat The pilot may also exit the tow test vehicle by climbing over the side after opening the canopy.

• **Electrical system** Two nickel cadmium batteries are used for primary and secondary power sources Through a secondary bus, the backup battery can be put on the line to power equipment essential for safe flight if the primary system malfunctions Two 115 v.a.c. inverters provide the necessary alternating current

• **Pneumatic system** Dry nitrogen is used to supply the winch control motors

First Extended Firing of J-2 Engine

Hydrogen fueled J2 rocket engine for Apollo missions underwent its first extended duration test firing of 510 sec. at 200,000 lb. thrust recently at Propulsion Field Laboratory of Rocketdyne division of North American Aviation, Inc. Engine originally was designed for 250 sec. firing time. Single J2 will power Saturn S-4B upper stage.

and to maintain wing pressure. The gaseous nitrogen is stored in separate bottles at 3,000 psi.

• **Landing gear.** Fixed, wheel type gear are used rather than skid type gear to ease ground handling and to allow the vehicle to be towed for takeoff. The vehicle is steered by differential braking. The shock absorption system is designed to accommodate sink rates up to at least 17 fps.

The cockpit of the tow test vehicle will be fitted with sufficient flight instruments to allow the pilot in the left hand seat to accurately reference his approach speed, altitude and attitude. Instruments include an airspeed indicator, altimeter, three-axis attitude indicator, vertical speed indicator and angle of attack.

Parachute Recovery

At the same time as the tow test vehicle flight test program is being conducted, the two unmanned full-scale test vehicles will be used to test paraglider deployment. Recovery of the full-scale test vehicle will be by parachute because it cannot be controlled in flight.

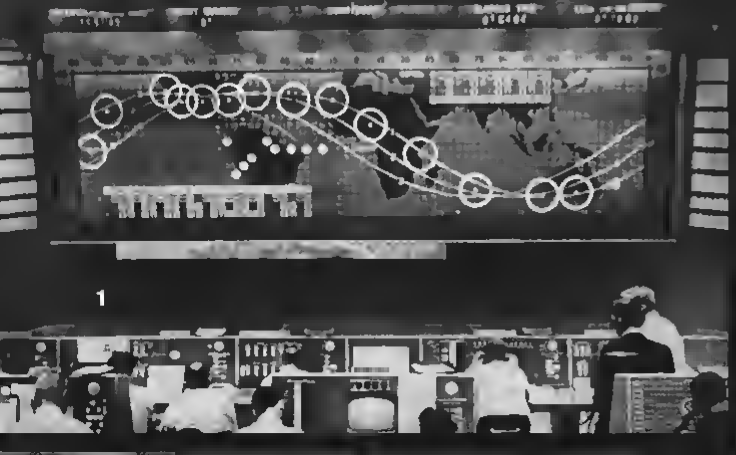
On a typical flight, the full-scale test vehicle will be carried to 33,000 ft by a Lockheed C-130. It will be dropped with the paraglider stowed inside the rendezvous and recovery (R&R) canister just as it would be in the Gemini spacecraft. The cylindrical R&R canister, located on the forward end of the full scale test vehicle, also contains a drogue chute for stabilizing the vehicle and unfurling the paraglider wing.

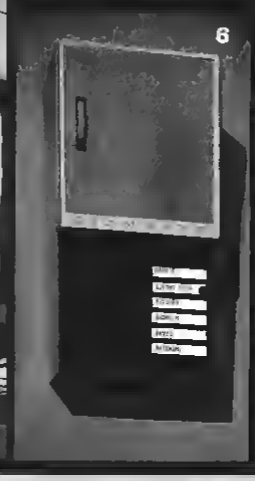
No Landing Gear

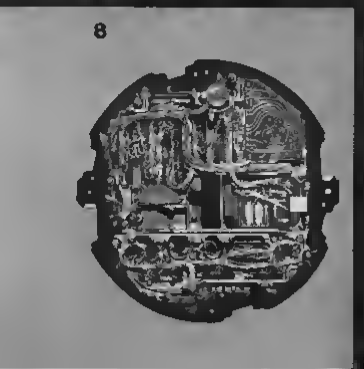
Since the full-scale test vehicle has no landing gear, it is mounted atop a sled which is pulled from the C-130 by an extractor chute. The sled is recovered by parachute after it is separated from the full scale test vehicle.

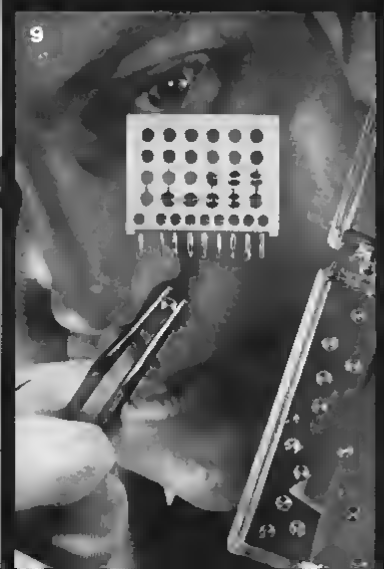
The 12 ft drogue chute is deployed soon after the vehicle is pulled out of the airplane and the sled is separated. The paraglider deployment sequence is begun between 26,000 and 27,000 ft. The entire sequence, from the first separation of the canister to full wing deployment, is expected to take only 27 sec. About 5,000 ft. of altitude will be lost in that time.

The full-scale test vehicle will then glide in a trimmed condition from between 21,000 and 22,000 ft down to









1. Visual display system at Project Mercury Control Center simultaneously shows flight path, capsule environment, and physiological reactions of orbiting astronauts

2. A six ton acoustic transducer provides a massive source of underwater sound in anti submarine warfare studies.

3. A high intensity laser beam cuts through a sheet of steel alloy

4. One of several types of antennae of the Global Tracking Network (Glotrac) for precision tracking of space vehicles orbiting thousands of miles high

5. Information from computers, radar and other communication links are displayed instantaneously to show an air traffic controller the identification, changing position, altitude and direction of aircraft in his vicinity

6. The transistorized "Signette" offers economical, high quality intercom service in homes and small commercial operations.

7. Tiny thermoelectric elements sandwiched between thin metallic sheets convert solar energy into auxiliary power for space vehicles.

8. An electronic 'wheel,' interchangeable and easily replaceable, is one of several which make up the guidance system of an air defense missile

9. Microminiature circuits are built up of semi-conductors in the form of tiny pellets interconnected simultaneously by conducting cement.

10. Ground hugging flights are made easier by a Terrain Following Radar system which helps guide an aircraft over unknown terrain in zero visibility.

11. The first commercial push-button telephone went into service in mid-1963

12. A new jeep-carried single-sideband radio is half the size of the set it replaces but provides ten times the effective signal power, and twice the range.

To show the whole range we'd need more than two hundred pictures

And each one, as do these twelve, would show a different kind of electronics research or production by General Dynamics. Of our thirteen operational units, nine are actively engaged in advanced phases of electronics, to make General Dynamics a key producer for defense, industry and space—and a major factor in keeping America strong.

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18,000 ft., where the wing cables will be severed on radio command. The wing, hopefully, will return to earth in a glide. A parachute stowed in the side of the full-scale test vehicle will be deployed to recover the vehicle.

The full-scale test vehicle will land on a crushable aluminum honeycomb bumper installed in the side of the vehicle. The honeycomb section actually replaces a vertical slice of the lower portion of the vehicle so that the outward appearance of the full-scale test vehicle is the same as the Gemini spacecraft. An outer covering of plastic reinforced with glass fiber covers the honeycomb.

A key area in development of the paraglider recovery system for Gemini has been the means of reliably deploying the flexible wing. The feasibility of using a flexible Rogallo-type wing to recover space hardware rests to a great extent on the reliability with which it can be deployed, because weight considerations rule out backup systems.

The projected full-scale test vehicle deployment sequence following stabilization of the vehicle and unfurling of its paraglider wing will run as follows:

- **Inflation begins with all points** still attached to the full-scale test vehicle. Nitrogen gas is fed to the wing support members through an apex fitting. With all extremal points still attached, the wing looks like an inverted pyramid.
- **The twin booms—restrained** now only by the roll cables—are then released to be followed shortly by the release of the keel as pressurization is completed. Total time required to pressurize to the maximum of approximately 12 psig is expected to be 22 sec. As the keel straightens, the vehicle begins to pitch forward toward a nose-down attitude. With the aft keel section straightened, there is only one bend remaining in the booms and keel—just forward of the diagonal pitch cable attachment. Nylon coreless cord bungees located between the steel cables and the wing absorb initial opening shocks.
- **Apex is released** and the forward cable is reeled out. As this cable is lengthened, the wing straightens. As the angle of incidence increases, the paraglider begins to pull out of its nose-down attitude and eventually it assumes a trimmed glide. After the forward cable has been winched out, it remains fixed.

Full-scale construction is similar to that of the tow test vehicle. Basic difference between the two vehicles is that the full-scale test vehicle is unmanned and cannot be maneuvered. Data will be gathered by telemetry and on board cameras just as with the tow test vehicle. For regular full-scale test vehicle operations, radio commands will be transmitted by ground based units. The C-130, however, can act as a backup in case of failure of the ground unit.

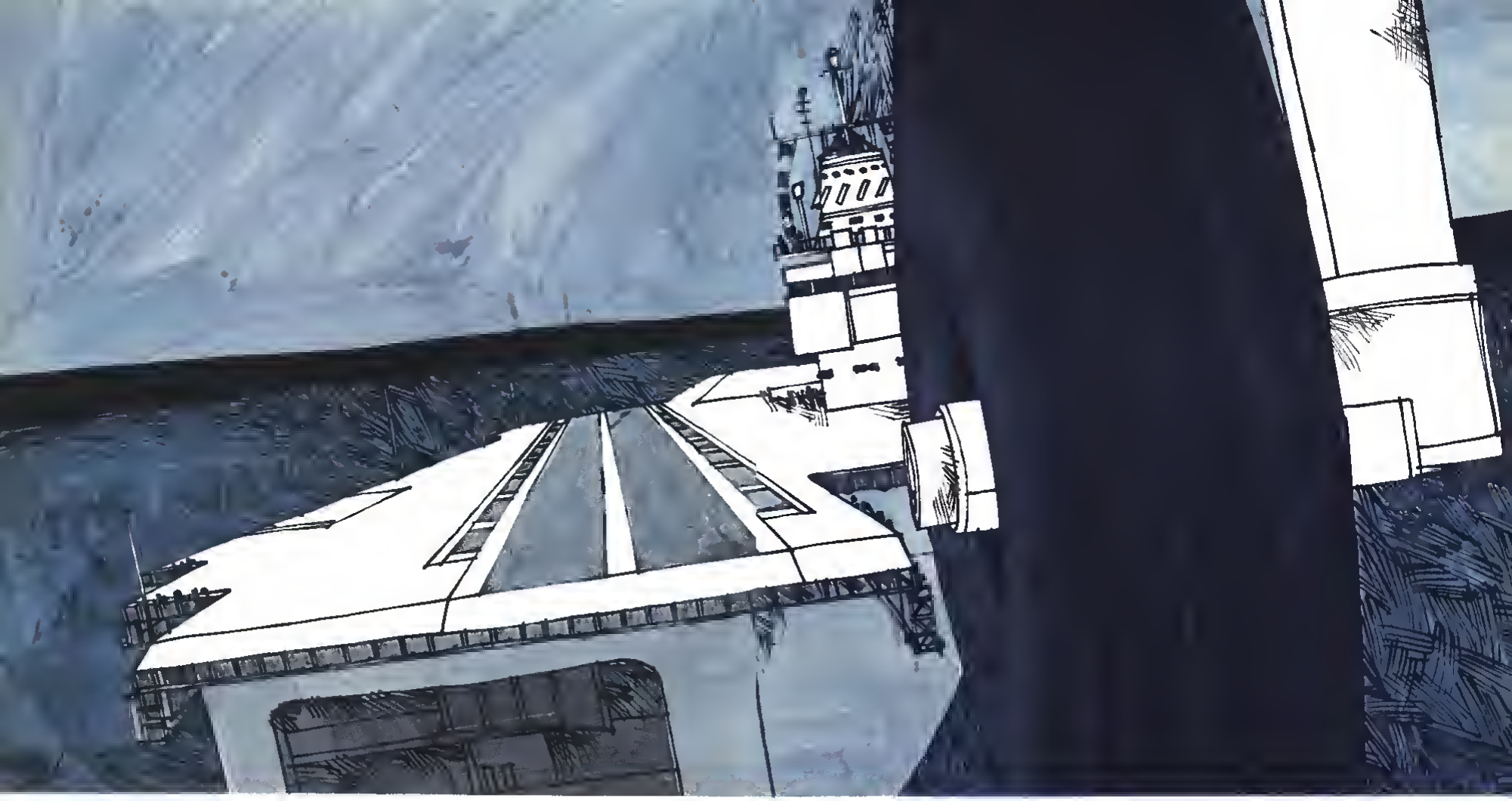
Both the full-scale test vehicle and tow test vehicle programs should be finished sometime in May, 1964, barring unforeseen difficulties. Primary reason for running two parallel programs is so that problems requiring vehicle modification will not restrict testing in non-related areas.

It is felt that by breaking the testing program into two parts, one of the major difficulties encountered in the paraglider development program—obtaining operational test data—will be overcome. (AW July 22, p. 62, Jan. 28, p. 55)

The next logical step in the Gemini paraglider program following the Edwards tests would be construction of a manned test vehicle for both paraglider deployment qualification and landings. Such a vehicle could be a modified Gemini boilerplate spacecraft. The tow test vehicle could also be used as a trainer for astronauts in a follow-on program.

Weight considerations in developing the paraglider have required that it be made of the lightest possible material. For this reason, two special high-strength, low-weight fabrics have been developed. Target weight for the Gemini wing is slightly greater than 500 lb., roughly four times the weight of the parachute recovery system.

Both fabrics are hot-stretched, heat-



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stabilized Dacron fiber. Neoprene is used to coat the material. The two fabrics, called Type 1 and Type 2 weigh respectively 9 and 12 oz. per sq. yard. Both fabrics have a maximum elongation of less than 25%.

For the wing to perform efficiently in flight, the boom and keel sections of the paraglider must be rigid. Serious stability problems arise when one or another of the cables goes slack. Therefore the booms and keel are fabricated largely from the heavier Type 2 material while the spreader bars are made mainly with Type 1 material to save weight.

The basic wing framework is made up of six subsections—an apex, two booms, a keel and two spreader bars. The subsections are fabricated on metal mandrels by first placing a layer of bleeder cloth on the mandrels and then laying up the uncured fabric over the bleeder cloth. Another layer of bleeder cloth is then placed over the wing material. The coarse weave bleeder cloth allows gas to escape during curing and also prevents the vulcanized subsection from sticking to the aluminum mandrel.

The mandrels then are bagged and placed in an autoclave where a vacuum is drawn inside the bag. Curing is at 75 psig. and 310F. Seven circumferential bonds are required to weld the subsections into a paraglider. The materials currently in use will perform up to specifications over a −30 to +140F temperature range.

For a Gemini paraglider wing, however, a different coating than neoprene would have to be developed to reduce the temperature tolerance to around −65F.

The sail is made of Fortrell, a commercial Dacron product.

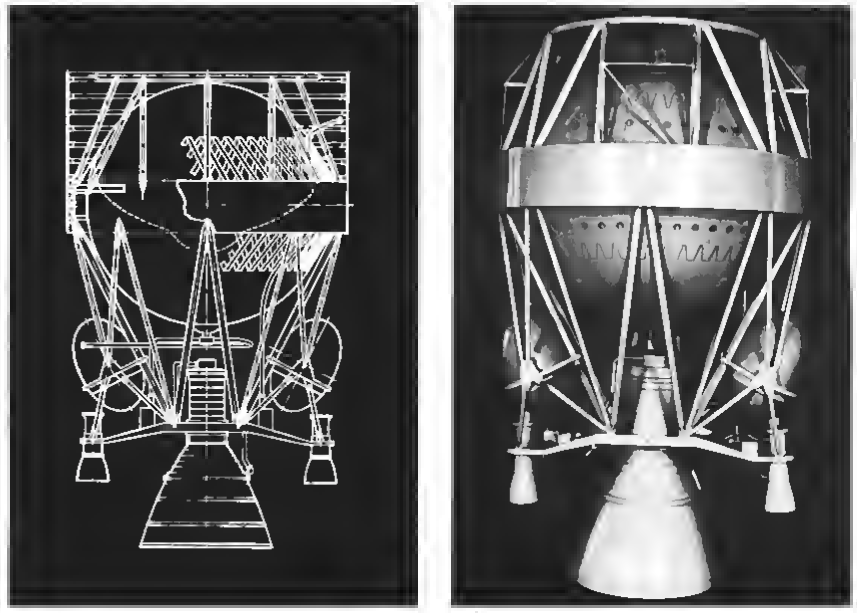
The total area of the sail measures approximately 600 sq. ft.

Nike-Cajuns Measure Lowest Temperatures

Washington—Lowest temperatures ever recorded in the atmosphere were measured by sounding rockets launched from Kronogard, Sweden, in the presence of noctilucent clouds last summer.

University of Stockholm scientists and the National Aeronautics and Space Administration announced recently that temperatures as low as −143C were measured in Nike-Cajun flights at altitudes of about 50 mi. when noctilucent clouds were present. Lowest temperatures recorded when the clouds were not present was about −120C. The findings support earlier conclusions that noctilucent or phosphorescent clouds are made up of ice-coated particles.

The U.S.-Swedish rocket flights also recorded swiftly changing winds at high altitudes.



ENGINEERING DRAWING OF ELDO THIRD STAGE (above, left) shows its general arrangement and key components. Note unusual elastic suspension system for the propellant tank, employing titanium bands bonded to the tank. Ellipsoidal bottles for the pressure feed system contain helium at 300 atm. pressure. Shells have been removed from a model (above, right) of the third stage to show thrust frame of welded 6061 T4 aluminum alloy stringers and titanium strong ring through which all loads pass. Gimbaled main engine develops 4,980 lb. thrust using a hypergolic combination of Aerozine 50 fuel and nitrogen tetroxide oxidizer. Verniers develop thrust of 110 lb. Trial series on the composite Anglo-French German vehicle is scheduled for the end of January.

ELDO Third-Stage Model Test Scheduled

By Warren C. Wetmore

Bremen, Germany—Entwicklungsring Nord is cutting metal for the vibration test model of the European Launcher Development Organization (ELDO) booster third stage in preparation for a series of trials on the composite Anglo Franco German vehicle.

Tests will begin around the end of January at the Hawker Siddeley facility in Hatfield, England, and will involve use of a dummy engine and simulated propellants in the German-made third stage.

Two other versions of the composite booster, bearing the designations F-2 and F-3, are also slated for ground tests next year. Following closely will be the flight tests of vehicles F-4, F-5 and F-6 in 1965 and early 1966, using live British Blue Streak first stages and dummy upper stages.

All five launches of the F-7, F-8 and F-9 vehicles are scheduled for the period 1966-67. These shots will carry the test satellites now under development by Italy as her contribution to ELDO. A back-up vehicle, the F-10, will be provided in case of a failure among the previous three. Site of all flight tests will be the Woomera, Australia, missile range (AW Dec. 9, p. 66).

The German third stage has the same diameter as the French-built second stage—6.58 ft.—thereby minimizing Entwicklungsring Nord's (ERNO) aerodynamic considerations.

Overall length from the satellite mating ring to the main engine exit plane is 11.2 ft.

For high orbit missions, the ignition weight of the third stage will be about 7,700 lb., including a 440-lb. payload. Maximum payload for low earth orbits is 2,650 lb. Basic empty weight of the third stage will be between 1,100 and 1,450 lb., depending on the degree of refinement that ERNO engineers can ultimately achieve.

Originally, Germany wished to use an advanced, high-energy cryogenic propellant combination—liquid oxygen/liquid hydrogen or liquid fluorine/liquid hydrogen—which would have resulted in an appreciable improvement in the overall performance of the composite vehicle (AW Jan. 7, p. 27). However, due to the uncertainties surrounding these combinations and the time that would have been required to dispel them in relation to the time scale of the program—the British first stage had been completed and the French were well along in their work on the second—the decision was made to go with conventional propellants in the ELDO initial program.

The exotic fuels were relegated to its future program (AW Sept. 30, p. 58).

Aerozine 50 fuel—a blend of 50% UDMH and 50% hydrazine—oxidized by nitrogen tetroxide, is the hypergolic combination finally chosen. This saved

weight by obviating an ignition system and, in addition, is storable for long periods of time. Specific impulse is approximately 285 sec.

The main engine will develop about 4,950 lb. of thrust, yielding an initial acceleration of 0.65g. Propellants are pressure fed to the engine by helium contained at 300 atmospheres in glass fiber filament wound bottles designed by Boelkow in consultation with Rocketdyne Div. of North American Aviation.

An uncooled experimental version of the main engine has been undergoing optimization tests at the German Aerospace Research Institute (DFL) facility at Trauen. Geometry of the conventional cylindrical combustion chamber, which is not yet fixed, is varied by use of graphite inserts. A regeneratively cooled version has been built and is also on the test stands.

In its final form, the powerplant will be cooled as far as the ring on its bell nozzle, although it is undecided as yet whether one or both of the propellants will be used as the coolant.

At present, the combustion chamber, injector head and throat are made of steel, but ERNO would like to employ aluminum from a standpoint of weight saving, with perhaps a titanium-alloy insert in the throat. Uncooled nozzle skirt is titanium strengthened by three rings circumferentially welded at equal intervals along the thrust axis.

Expansion ratio ($P_{c/e}$) for the engine is 1,000, which, with the design chamber pressure of 128 psi., gives an exit plane pressure of 0.128 psi. Thus, ideal expansion occurs at about 106,000 ft., at which altitude the engine will never be operated. Engine and vacuum tests for the stage will be conducted at Boelkow's test facilities at Lampoldshausen and Ottobrunn.

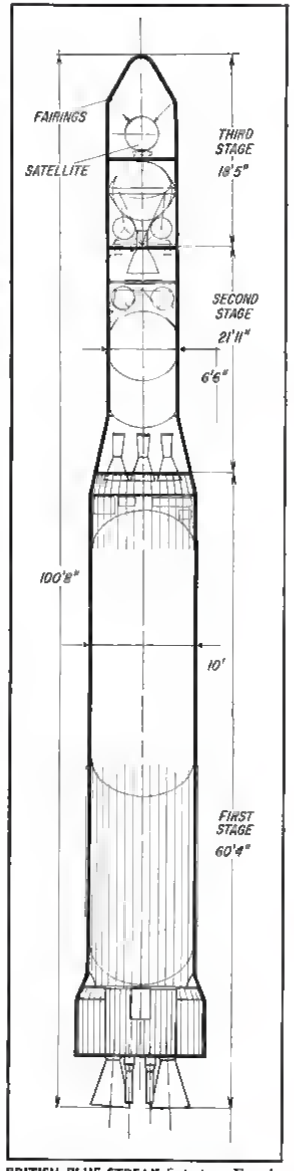
Propellant injector head uses impinging stream mixing. Two-position delay valves on both oxidizer and fuel lines permit injection of a small amount of the propellants to obtain the spontaneous ignition flame, after which they open completely for full thrust.

No throttling capability is provided for the main engine. Propellant consumption is time-controlled—burning time is 6 to 7 min.—and hence there are no level sensors in the propellant tank.

Thrust vector control is obtained by gimbal-mounting the main engine. Maximum excursion is 4 deg. in any direction.

Two gimbaled vernier engines, each generating 110 lb. of thrust, supply roll control as well as additional moments in the pitch and yaw planes. Maximum excursion of these engines is ±40 deg. in pitch and 80 deg. in yaw, using Junkers hydraulic actuators.

Vernier thrust is a compromise with the 354-lb. rating the British wanted to



BRITISH BLUE STREAK first stage, French second stage and German third stage make up composite booster for ELDO initial program. Italian test satellite is in nose fairing.

effect a 1¼-hr powered transfer to the 8 hr period orbit Smaller engines would also permit a more precise orbital injection velocity, but present unsurmountable cooling problems during long runs

Burning time for the verniers, as things stand now, is about 20 min., and chamber pressure is 76 psi

Parallel development of a 66-lb thrust vernier is also under way at Boeing Kow This smaller engine may be used if successful

Strong Ring'

Load-bearing structure features extensive use of titanium at critical points Stringers are of 6061-T4 aluminum alloy tubes in two sizes The 1.97-in O.D stringers are used for primary connection of the engine mounting bracket below and the satellite mating ring above to the foot wide titanium "strong ring"—the nucleus of the structure through which all forces pass—located at the equator of the spherical propellant tank The smaller, 1.19-in O.D stringers serve as cross-bracing for the engine bracket and support for the two helium bottles

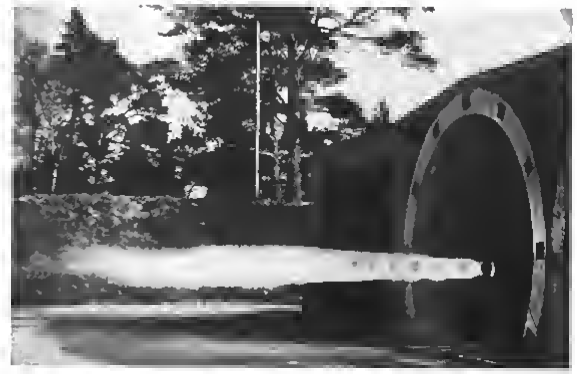
Upper framework is formed of 16 of the large stringers welded into four M-shaped structures and bolted at equal intervals to the strong ring These units are canted inward and welded at the top to the satellite mating ring Avionics packages for control and instrumentation are mounted between the vertical bars of the M frames

Lower Structure

Bolted at 90-deg intervals around the strong ring are the vertices of the four inverted V units comprising the primary lower structure Bottoms of each are welded to the four main weld flanges on the engine bracket

Interstitial structure of the smaller-diameter tubing for cross bracing and support is also in V form Four of these units, each with a truncated leg, have their vertices bolted to the string ring at even intervals between those of the primary units The longer leg is welded to a main weld flange on the engine bracket and the shorter to the flange on the appropriate side of the helium bottle bracket Another two such units are bolted 180 deg apart to the strong ring and the vertex of the adjacent primary inverted V with their legs straddling the helium bottles and welded to the bracket weld flanges The final four units connect the main weld flanges, those on the helium bottle brackets and the flanges on either side of the vernier rockets at the extremities of the engine mounting bracket.

The two collar brackets for accommodating the helium bottles are similar in concept to the egg containers in a refrigerator door—the bottles nestle to



EXPERIMENTAL VERSION OF MAIN engine undergoes mixture ratio and dimensioning tests at the Tranen test facility of German Aerospace Research Institute (DFL) Length and diameter of combustion chamber are changed by means of graphite inserts.

about 40% of their length, and probably will be bonded in place Further rigidity of this mounting is obtained by the two holes on one side of the collar brackets, through which pass the legs of the adjacent primary inverted V unit

Sinusoidally-corrugated shell is fabricated of 0.005-in titanium above the strong ring, to which it is affixed by continuous spot welding Two piece steel skirt below the ring will be jettisoned shortly after third stage separation In addition, there is a mid-shell over the strong ring.

Spherical propellant tank is elastically suspended from the strong ring by means of an overlapping pattern of titanium bands, each folded over in the middle to form a V Vertex is prestressed and bonded to the tank and the

cuds are spot welded to the strong ring

Material of the 5.97 ft dia tank is 0.032 in titanium alloy containing 13% vanadium, 11% chromium and 3% aluminum. Upper portion of the tank, which holds the Aerozine 50 fuel, is separated from the nitrogen tetroxide in the lower part by a concave diaphragm dimpled at the central outlet. Volumes of the upper and lower tanks are 48 and 46.5 cu ft, respectively. Thus at full capacity the divided tank will hold 2,630 lb of Aerozine 50 and 4,040 lb of N_2O_4 at 85F. Helium ullage pressure in the tank is nominally 20 atmospheres.

Upper and lower hemispheres for the tank are explosively formed, using actual explosives, and then conventionally welded together after the diaphragm has been welded into the upper hemisphere. Plans call for use of electron beam welding in the future.

Avionics on the third stage is primarily the responsibility of Boelkow, and includes:

- **Radio command guidance** unit, which receives and executes commands transmitted on a frequency of 700 or 1 400 mc from the Belgian MBLR down range ground stations. Trajectory correction commands stem from ground radars.
- **Pitch** programmer and, possibly, a roll programmer will be utilized.
- **Attitude control** system, at the heart of which is an inertial reference platform that utilizes three or four gimbals.
- **Instrumentation** including 250 test points at vital locations throughout the vehicle, the data from which are transmitted to the ground stations by means of the Dutch-built telemetry system.

During staging, the third stage engines will be ignited while the third stage is still attached to the second. After pressure in the interstage section builds to 7 psi, the explosive bolts will be fired and the "pop-gun" effect will cause the two stages to separate, aided by the retrograde rockets on the empty, 3,300-lb second stage.

Fabrication of the ELDO third stage is broken down among the member companies of ERNO as follows:

- **Focke-Wulf GmbH**—thrust frame, satellite mounting and final assembly.
- **Hamburger Flugzeugbau GmbH**—mid dle and lower shells.
- **Weser Flugzeugbau GmbH**—engine to be built at the Varel plant, propellant tank at Lemwerder and upper shell and strong ring at Einswarden.

Funding level for the ELDO third stage is currently $8.76 million.

Funding for the project is expected to rise in 1964.

Linkage of Spacecraft Studied for Space Lab

Linking of two or more modified Apollo spacecraft to perform as a space sciences laboratory for long-duration missions—or similar configurations utilizing Gemini vehicles for shorter-duration flights—will be emphasized in follow-on studies being conducted by North American Aviation's Space and Information Systems Div.

The company has been awarded a contract amendment valued at $49,000 by National Aeronautics and Space Administration's Manned Spacecraft Center, Houston, Tex.

Under the amendment, the contractor will consider concepts establishing the number of modules that can be used and design of either zero-gravity or artificial gravity environments. Also considered will be whether identical power and environmental systems should be placed in each Apollo or Gemini module or whether a central system could supply all modules.

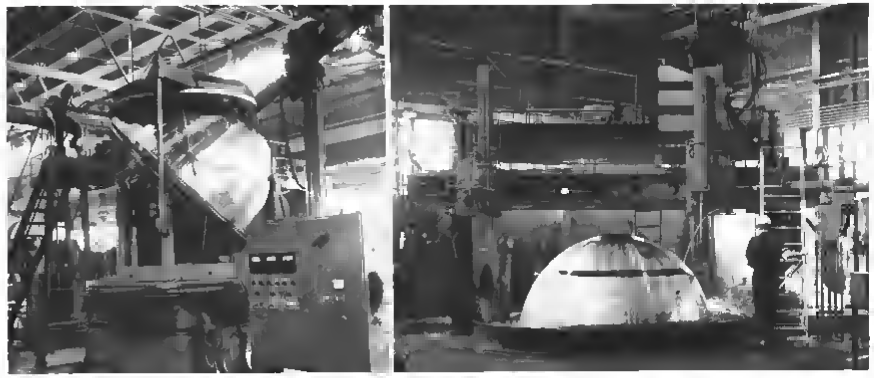
North American's initial $100,000 study which covered the Apollo vehicle concerned a single modified spacecraft serving as a space sciences laboratory for a 100-day mission or three or four vehicles used consecutively.

Body of a Titan 3C 120-in.-dia. solid propellant rocket case is moved from the delivery platform of Curtiss-Wright Corp.'s new Aeronautical Div. facility at Wood-Ridge, N. J., in form of large sheets of D6AC steel (left). Cylinder is clamped (right) for welding.

Curtiss-Wright Plant Handles Titan 3 Components

Welds are X-rayed, dye-checked and Magna fluxed. Workman (left) checks 260-KVA diameter X-ray unit used to inspect joints. Rolled and welded cylinders are trimmed in missile lathes (right). Male and female clevis joints are girth welded. Joints are machine finished.

Igniter and nozzle bosses are welded to forward and aft dome closures by automatic welder (below, left). Closures then are put in vertical boring mill (below, right) for finished contouring. After additional welding end closures are stress relieved and painted.



URGENT:

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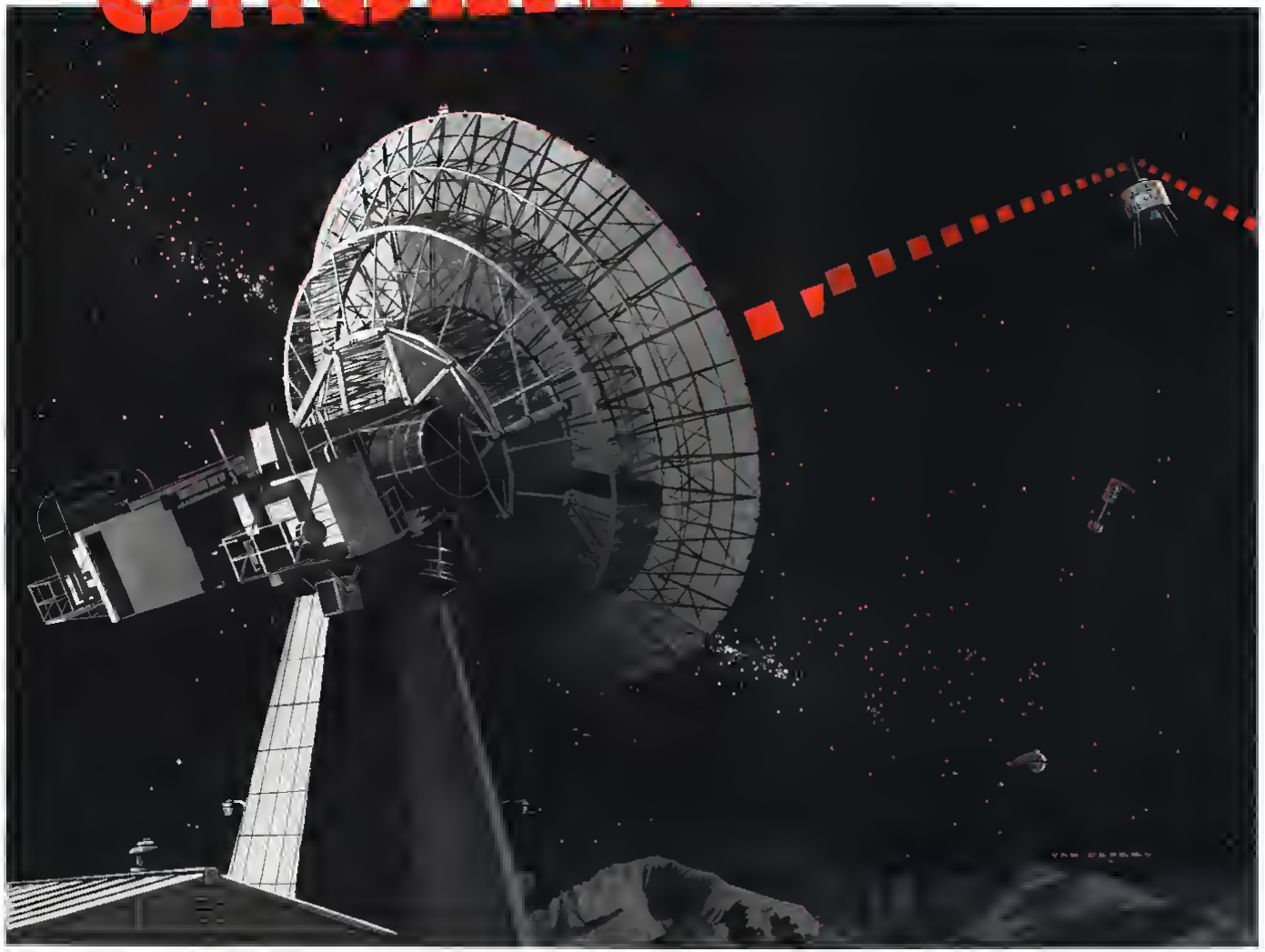

Finding ways to make a worldwide network of communications satellites completely practical is a challenge we are meeting today at General Telephone & Electronics.

Not long ago an antenna developed for the U.S. Army Satellite Communications Agency by our Sylvania subsidiary contacted the NASA SYNCOM II satellite at an altitude of 22,300 miles, and provided a communications link between California and the West Coast of Africa. This distance—7,700 miles—is the greatest yet spanned between two points on earth by way of a communications satellite.

More important is the performance of the Sylvania antenna. It tracked the orbital satellite within 24/1000th of a degree—an accuracy far in excess of any comparable equipment. Because of this performance, this 60-foot antenna not only provides communications, but can accurately track and command satellites in low, medium and synchronous orbits. And Sylvania has placed two such antennas and associated ground terminals in operation, which stand ready for future communications satellite programs.

Working with government agencies providing support equipment for future worldwide communications systems is one of the many ways that the scientists and engineers of the General Telephone & Electronics corporate family advance the nation's progress in space. The vast communications and electronics capabilities of GT&E, directed through Sylvania Electronic Systems, can research, design, produce, install and service complete electronic systems. These systems include detection and tracking, electronic warfare, intelligence and reconnaissance, communications, data processing and display.

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Transition from vertical to horizontal flight by Lockheed-Georgia's XV-4A Hummingbird VTOL turbojet aircraft is shown in sequence, above. Hummingbird, powered by two Pratt & Whitney JT-12 engines, was produced under a $2.5 million fixed price contract from the Army Transportation Research Command. Vertical mode takeoff is shown above, left, and aircraft in hovering flight, above, right.

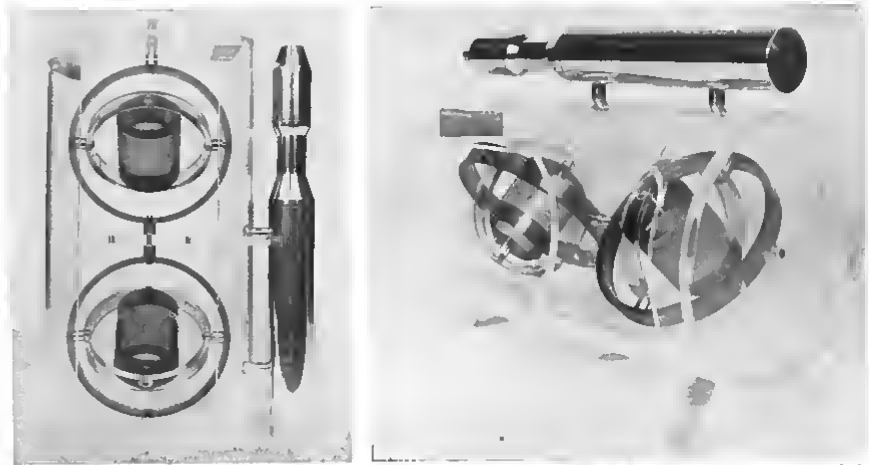
Transition from VTOL to Horizontal Flight Mode

Liftoff of XV-4A to low hover position is demonstrated in front of hangar, above. Transition to forward flight is shown from a different angle, right. Note nose down attitude, intended to introduce horizontal thrust component from the ejectors.

Continuing flight sequence from opposite page, XV-4A is now in high hovering flight, still in the vertical mode (above, left). Note open bomb bay-type doors at top and bottom of fuselage, permitting the engines' high-velocity exhaust gases to mix with free air, providing vertical lift. Conversion to forward flight is being completed, above, right. Note that lift doors are now closed.

Demonstrated by XV-4A Hummingbird Turbojet

Conventional flight to vertical mode transition has just been accomplished (left). Low hover to touchdown in vertical mode is shown, right. Transition is started at about 50 kt., with full lift available at about 120 kt. Aircraft is capable of over 500 mph.



ATTITUDE GYRO gimbaling arrangement for Athena velocity package shown for conditions prior to launch (left) and when vehicle is finally pointing before ignition of third stage (right). Note (left) that outer two gimbals are in plane of rocket's trajectory, the inner gimbals are perpendicular to one another and skewed 45 deg away from orthogonal to the roll axis.

Crab-Oriented Gyro Produced for Athena

By Barry Miller

Los Angeles—A compact, low cost attitude control system, employing a pair of free gyros in an unusual crab configuration to maintain constant earth reference, is expected to aim the Air Force's solid-propellant Athena rocket to within approximately 1 deg of preselected direction on re-entry in a major series of forthcoming overland flights.

The attitude control system, or attitude controller, was developed by Honeywell under a $4.5 million contract from Atlantic Research Corp., Athena integrating contractor for the Ballistic Missile Re-entry Systems Office of USAF's Ballistic Systems Div. Aerospace Corp. is technical direction contractor for the program.

Several of the first increment of 78 of these controllers being built by Honeywell's Military Products Group are now at Green River, Utah, preparatory to being installed in the first Athenas scheduled for launch on Feb. 8.

Air Force is planning an open-ended series of Athena flights, probably in excess of the 77 shots already announced, extending over at least 18 months, as part of its Advanced Ballistic Re-entry Systems (ABRES) program.

Launched from Green River for impact in the White Sands Missile Range (WSMR), about 470 mi. away, the four-stage Athena rockets will inject a variety of payloads into carefully predetermined re-entry corridors, which the attitude controller will make possible, so as to simulate the re-entry trajectory of an ICBM. Payloads will include ballistic missile decoys, subscale models of new kinds of re-entry systems components of operational re-entry vehicles and specialized target vehicles designed to check out Army, Air Force and Advanced Research Projects Agency radars located at the White Sands Missile Range.

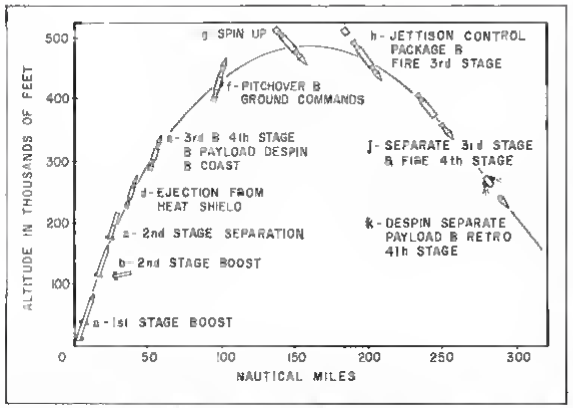
The advantages of using Athena (AW Sept. 2, p. 26) as a substitute for an actual ICBM in flights inside the continental U.S. rather than overwater from either major missile range are probably several. These would include a sizable reduction in booster costs with a relatively inexpensive rocket like Athena. Also, the smaller rocket permits use of WSMR, consequently avoiding use of already heavily scheduled coast ranges. The ability to test new systems inland over sparsely populated regions without fear of observation by foreign trawlers or submarines may also be important.

Consistent with the low-cost theme that appears to pervade the Athena program, the Honeywell attitude controller represents an attempt to get the desired attitude control accuracy with a minimum cost system. The company says the cost of its attitude controller is less than half that of a strap down inertial system it is producing for another rocket program.

The Athena controller is a completely self-contained unit, weighing 82 lb. and mounted aft of the third stage rocket. It consists of an attitude reference, by which desired direction is defined, a nitrogen gas reaction system to maneuver the final two stages and payload with respect to the attitude reference, command transducers that accept ground initiated commands from an on-board command receiver for in-flight attitude changes to correct orientation to offset dispersion from the nominal boost trajectory, three rate gyros for damping, a timer control electronics, power supplies and signal conditioners.

The control package measures 14 in. in length and is 18 in. in diameter. (See layout of components, photograph p. 88.)

This attitude controller is the single control system aboard the vehicle and it operates only following second stage separation and until just prior to third stage ignition. Athena's anticipated mission profile calls for boost beyond



FLIGHT PROFILE of Atlantic Research Athena solid propellant rocket during forthcoming tests from Green River, Utah, to White Sands Missile Range (AW Dec 17, 1962, p. 23) Honeywell attitude controller situated in package between second and third motor stages, re-orients final stages and payload after second stage separation so that vehicle is pointed for proper re-entry angle takes command from White Sands for trimming orientation and is jettisoned prior to third stage ignition

the atmosphere (see flight profile, above) of the so-called velocity package The latter comprises the final two rocket stages, the jettisonable control package and the payload

Prior to second stage separation the velocity package is spun up by canted fins on the stage to 3 rpm to provide for aerodynamic stability after second stage separation

At separation and ejection of the velocity package from the heat shield which protects it during boost, the timer within the controller package is activated Then, it automatically sequences the controller through its various modes These include partial despin by an Atlantic Research yo-yo de-spin device, yaw and pitch rate arrest and roll acquisition (stopping vehicle rotation and assuring orientation), requiring 22 sec The package is then pitched over, nominally from 90 to 130 deg., and yawed to a predetermined attitude with respect to launcher coordinates

During its early flight, the vehicle is tracked from Green River, tracking data sent via link to WSMR where an IBM 7094 computer calculates dispersion of the actual flight path from the nominal trajectory and determines corrections necessary for achieving proper re-entry trajectory The corrections are transmitted to the vehicle and entered through the command transducers into the attitude controller Twenty seconds are allotted for maneuvering to the new attitude

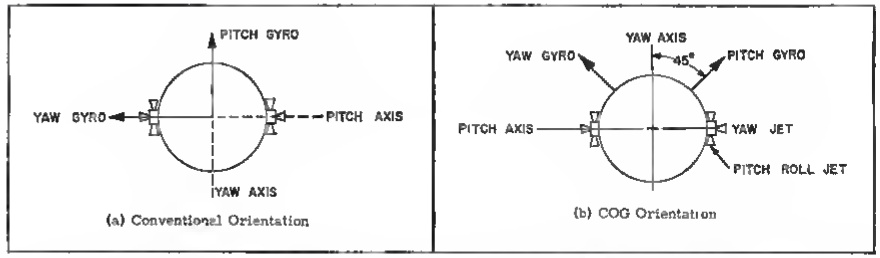
By ground command the velocity package is spun up again, this time by the gas jet system of the controller, to provide for spin stabilization during re entry acceleration Finally, the attitude control package is deactivated and the control package jettisoned Following in sequence the third and fourth stages are ignited, the payload de-spun and the fourth stage retro rockets fired to slow the final stage The payload, moving away from the final stage, travels toward impact at re-entry angles varying between 18 and 45 deg at altitudes of 225,000 ft

Heart of the attitude controller is the attitude reference system, a pair of two axis gyros, arranged in what the company calls a crab-oriented gyro (COG) configuration In this gyro gimbaling arrangement the orthogonal yaw and pitch momentum vectors are rotated 45 deg from the vehicle axes

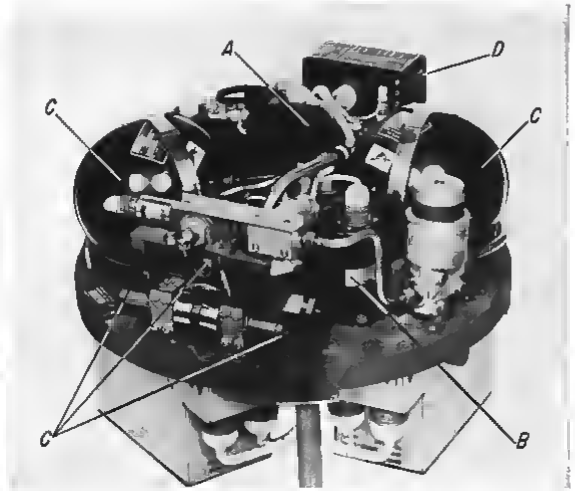
In a more conventional attitude control configuration the gyro spin vectors are in the same plane as the body coordinates of the vehicle, Honeywell points out With the gimbals orthogonal to one another, a pitch or yaw maneuver is detected as a direct movement in the inner gimbal of the respective pitch or yaw gyro Roll attitude reference is defined by the outer gimbal of either of the gyros.

In Honeywell's COC system the vehicle is maneuvered so that the inner gimbals are again in an orthogonal relationship But in this case, they are skewed 45 deg from the conventional yaw and pitch axes The output from the inner gimbal of one gyro (arbitrarily selected as pitch gyro) is used as the attitude reference of the pitch axis, the inner gimbal of the other gyro as yaw axis reference.

The advantages of the COG arrangement, according to Honeywell, are twofold It enables the system to accommodate unlimited pitch without en-



CRAB ORIENTED GYRO configuration (right) is contrasted here with conventional orientation (left) COG has inner gimbals orthogonal to one another, but skewed 45 deg with respect to conventional pitch and yaw axes System can accommodate unlimited pitch



ATHENA ATTITUDE CONTROLLER, comprising two attitude gyros (one shown at A) in crab configuration, three rate gyros, two command transducers (one shown, B), reaction jets and fuel tanks (C), timer (D), power supplies and other avionics, mounted on circular magnesium alloy casting.

countering gimbal lock or tumbling of the gyros. It also minimizes spin drift errors in the inner gimbals of the two gyros which are supplying the pitch and yaw attitude signals in the final pointing of the velocity package.

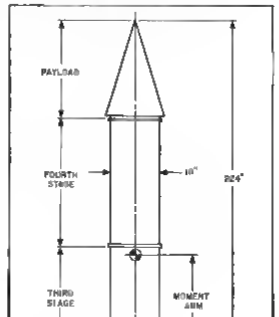
Total gyro drift, due to precessional torques experienced when the vehicle is spinning and during boost can be predicted to within 1 deg or less. Knowing this, company engineers can offset the gyro spin axes before launch by the predicted drift angles.

Before launch, gyro gimbals are oriented to an earth-fixed coordinate system. Then, a ground alignment, slaving system will offset the gyro alignment by an amount equal to but opposite the predicted drift angles and hold this during arming and countdown.

In this way, according to Honeywell, after the velocity package has been put through its programmed maneuvers, the resulting attitude reference gimbal positions will be orthogonal, making possible control with respect to the orthogonal inner gimbal axes.

Gimbal synchro transformers supply signals for activating the reaction jets without requiring any coordinate transformations. The initial roll acquisition maneuver uses one outer gimbal for attitude reference, while pitch and yaw axes are rate stabilized.

On timer command, the company explains, a signal from the inner gimbal of the designated pitch gyro initiates the pitchover maneuver. At the same time, the vehicle is stabilized in yaw on the basis of the difference in the inner gimbal axis signals and roll attitude



VELOCITY PACKAGE of Athena vehicle—consisting of final two Athena stages, payload and attitude control package. Two gas jets, normal to vehicle axis, provide for yaw maneuvers, while four remaining jets in same plane, fired in different combinations, will pitch or roll velocity package. Attitude control package is jettisoned after vehicle is pointed for proper re-entry angle and before firing third stage.

control is switched to a signal representing the sine of the sum of the outer gimbal positions. The latter two signals, Honeywell says, handle the simultaneous rotations of both the inner and outer gimbals during this pitchover mode.

Pointing of the vehicle on its final re-entry path is provided by inner gimbal signals of the COG gyros. The sum of the outer gimbal signals satisfies need for roll reference. Control transformer output summed with the synchro output drives the system to its final pointing attitude, according to Honeywell. Changing control transformer output by signal from the ground through the command receiver and transducer will cause the system to change attitude.

New ESD Laboratory Tests Data Concepts

Bedford, Mass.—Ability to explore in rapid sequence a number of alternate concepts for future command and control systems and to investigate in depth improved techniques of man/computer information exchange are among the prime benefits that USAF's Electronic Systems Div. expects to derive from its new Systems Design Laboratory at Laurence G. Hanscom Field here.

The new 45,000 sq. ft. facility, recently dedicated, will be operated jointly by the Electronic Systems Div. and the Mitre Corp., non-profit technical adviser to ESD and other government organizations.

Constituting a "general purpose simulation tool that can be adapted to simulate a wide range of command and control problems," according to the division, the laboratory provides two command posts on its upper floor which may be configured to test proposed systems or subsystems under simulated operating conditions.

Equipment includes tactical situation display consoles, closed-circuit projection television, which may be seen on dynamic or static wall display screens measuring 9 x 12 ft., special telephone equipment, monitoring and recording devices, and remote, high-speed printouts.

Directly or indirectly, displays and high-speed communications facilities are controlled by an IBM 7030 (Stretch) computer, which is housed on the lower level of the Systems Design Laboratory.

Observation rooms are provided in the rear corners of the command posts, permitting evaluation of system exercises by unseen observers.

In line with its objective of improving man/computer communications techniques, the laboratory is experimenting with methods of making data displays more effective, and with ways

of enabling human operators to enter data into a system more easily and without resorting to machine language and programmers.

USAF feeling is that proper testing of new systems requires simulation of actual operating conditions including the handling of large masses of data, and with this the ability to make precise measurements of the findings.

Primary needs in the command and control field, as enumerated by USAF officers, are:

- **Flexibility** provided by computerized systems that enable commanders to adapt their command and control systems to the needs of any situation at short notice.
- **Greater speed**, which may require new design concepts and tremendous changes in computer organization.
- **Capacity**, or the ability to manipulate larger amounts of data, but with no sacrifice of the foregoing qualities of flexibility and speed.

The role of the Systems Design Laboratory in meeting these demands lies in its ability to simulate problems and test their solutions in a laboratory which ESD expects will enhance its systems design capability.

During a demonstration simulated data readouts in the command post included a Scletric 1050 typewriter, which was used by personnel for inquiry to the 7030 system and printout of the information (buffered by a 7750 teleprocessing unit), medium speed printer/plotter printout, cathode-ray console display designed to be read under high ambient light conditions and closed-circuit television display, using the data displayed on the cathode-ray tube.

PROBLEMATICAL RECREATIONS 201

A man is one year older than his wife, and their son is one year older than his wife. The product of the parents' ages is 17 times the product of the ages of their son and daughter-in-law. What are their ages (integers) if their son is not a teen-ager?

—Contributed

A product of our Data Systems Division is the efficient, mobile, tactical air control system known as MODICON. Combat-ready and completely portable, the system can be air lifted by three C-130A cargo transports. MODICON is automated, capable of controlling mixed weapons modularly dispersible and adaptable to field conditions. What more can we say? (We might add that the R&D's been paid for and the system is now in production.)

ANSWER TO LAST WEEK'S PROBLEM: −3, −1, +1.

FILTER CENTER

► **ILAAS Bids Finally Sought**—Industry proposals for program definition phase studies of an advanced avionics system for future naval attack aircraft, designated ILAAS (integrated light attack avionics system), were requested recently by Navy's Bureau of Weapons. Navy briefed industry on ILAAS, then known as the Vax avionics system (AW Apr. 1, p. 89) earlier this year, and bid requests were in the offing since then. The system is to completely integrate all airborne avionics gear, including communications, IFF and radar, and will have a computer central complex. Proposals for the cost-no fee studies are due on Dec. 30. Naval Air Development Center is technical consultant.

► **Advanced Reconnaissance Explored**—Advanced techniques for improving aerial reconnaissance are under study at McDonnell Aircraft, probably prompted in part by the confusion in gathering and processing reconnaissance information during the Cuban crisis last year. One possible approach might be to perform more processing of data from various recon sensors in the air to save time and permit the reconnoitering aircraft to perform strike functions on the same mission.

► **Emergency Airborne Long-Range Communications** — An experimental long-range airborne communications system for emergency link between defense centers was developed recently by Sylvania Electric Products, Inc., under subcontract to Boeing for the Air Force. Tests suggest that the system could successfully transmit to most points on the continent from a 2-mi. wire antenna attached to a Boeing KC-135. The development was part of Aeronautical Systems Div.'s Project 'Black Box."

► **New Tactical Communications** — Laboratory for Electronics, Inc., is performing design studies of new communications gear suitable for rapid deployment to advanced tactical bases. The work is being done for USAF's Electronic Systems Div.

► **Better Mechanical Packaging**—Various methods of improving the mechanical packaging of military electronics equipment will be investigated in a one-year program planned by the Army Electronics Materiel Agency. The program will focus on mechanical reliability, shock and vibration resistance, thermal design, size and weight reduction and ease of maintenance.

(Continued on p. 95)

Antenna Mounts Helices Aft of Rotation Point

Helices of six-element antenna capable of tracking missile launch in the 215 to 260 mc range are mounted aft of rotation point of the array so that the center of gravity of the array and the pedestal axis are brought closer to provide better mechanical stability. Antenna swings through 200 deg in elevation and is continuous in azimuth. The six-helix array provides 18-db gain and has excellent circular polarization characteristics, according to Electronic Specialty Co., which made the antenna for Douglas Aircraft Co. Ground planes on the helices are counterweights

(Continued from p. 92)

► **Saturn Orbital Countdown Technique Awaits Decision**—Checkout procedures for the Douglas S-4B Saturn 5 stage prior to engine restart after earth orbital coast are not yet defined, pending crystallization of flight operational philosophy at NASA's Manned Spacecraft Center. Details of orbital countdown system will depend largely on how much in-flight countdown control will be delegated to astronauts. A heavy ground checkout responsibility could create serious orbit-to-ground communications problems possibly making duplicate ground facilities necessary. The S-4B on first burn will inject moon bound Apollo spacecraft into earth orbit, later will restart to launch Apollo on its lunar trajectory. While other phases of S-4B checkout will utilize an automatic computer-controlled checkout system being developed by Douglas decision as to whether orbital checkout will also be fully automatic also awaits decision.

► **Airborne Cable Detector**—Helicopter obstacle warning system, capable of detecting airborne ¼ in. dia. steel cables at range of 300 ft., has been demonstrated by North American's Autonetics Div. Company says the detection range can be extended to 1,300 ft.

► **Thermal-Shock Resistant Seal**—Invar ceramic joints capable of withstanding sudden changes in temperature from 20C to 269C have been developed by National Bureau of Standards scientists. In addition to use in cryogenic equipment, new seals could find application in equipment which must operate on lunar surface.

NEW AVIONIC PRODUCTS

• **Microwave receiver calibrator/troubleshooter,** Model 150792, enables semi-skilled personnel to make complex measurements of sensitivity, selectivity and frequency accuracy both for manual and servo-controlled superheterodyne frequency converters. Test set includes oscilloscopes, frequency counters, detectors and marker generators. In each band, 11 preprogrammed frequencies are available on push-button control panel for tuning both generator and converter. Manufacturer: Lomal Electronics Corp., 825 Bronx River Avenue, New York 72, N. Y.

• **Spectrum analyzer,** Model MRFR 150-2, for analysis of acoustical or random noise over frequency range from 3 cps to 13 gc (kmc.) is available with 50 parallel filter channels spaced 2 cps apart to provide resolution to 5 cps in a 100 cps range. In 1 kc range, 100 parallel filter channels provide 25-cps resolution. Channel outputs are sampled by a low-noise switch at selectable rate ranging from 13,000 per second. Sweep voltages are supplied for X-Y plotter or oscilloscope output. Analyzer is assembled to order from stock components. Manufacturer: Raytheon Co., Industrial Components Div., 55 Chapel St., Newton 58, Mass.

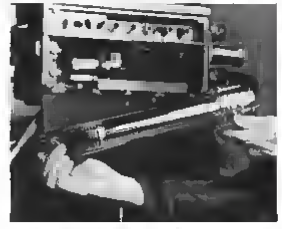
• **Laser flash tubes,** available in five new models, range in output from 2,000 watt-sec. to 100,000 watt-sec. Largest, Type FT-79, measures 1 in. dia. x 3 ft long. General Electric Photo Lamp Dept., Nela Park, Cleveland, Ohio.

• **Automatic film reading system,** capable of reading 5,000 data points per second from 16-mm. or 35-mm. film, consists of digital computer, visual display scope and film reading device. Film is scanned by rapidly moving light point on display scope. Output, detected by photocell in film reader, is relayed to computer for processing and analysis, providing printed, or tape or visual displays of results. System also can be used to analyze data recorded on any light-permeable medium such as lightweight paper. Manufacturer: Information International, Main St., Building 6, Maynard, Mass.

• **Frequency standard,** Model 1010, with temperature stability quoted at better than 5×10^{-9} at temperatures between 0C and 50C, has outputs at 1 mc and 100 kc. Available optionally are spectrally pure 5 mc crystal filtered output 10 kc, 1 kc and 1-, 10 and 100 pps outputs. Frequency standard employs silicon transistors and a double oven, weighs 20 lb. Manufacturer: Motorola Communications Div., 4501 West Augusta Blvd., Chicago 51, Ill.

• **Directional coupler,** Model F610, covers full waveguide bandwidth of 90-140 gc (kmc.) with nominal accuracy of 0.5 db, directivity of 40 db and a frequency sensitivity of 0.6 db. Device is available with coupling values of 3.8, 6, 10 and 20 db with mainline VSWR of 1.11 for all values. Auxiliary line VSWR is 1.21 maximum. Manufacturer: FXR, 25-26 50th St., Woodside 77, N. Y.

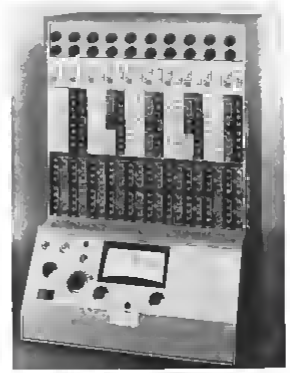
• **Ultrasensitive image orthicon,** Type WX-4861, for use with light levels as low as 3×10^{-5} foot-candles on the photocathode uses thin film metal oxide target which permits resolutions up to 3,000 TV lines and use of time exposure techniques before reading out image. Resolutions above 600 lines have been achieved with integration times of more than 10 sec., according to manufacturer. Westinghouse Electronic Tube Div., Elmira, N. Y.



• **Sampling-storage oscilloscope,** Model 1220/701, displays signals from d.c. to

5 gc (kmc) and offers sensitivity of 2 mv/cm. Device provides dual-channel sampling with each channel having rise time less than 0.5 nanosec. Both channels have built-in signal delay lines to display pulses without external triggering. Scope can be programmed externally for automatic display of a series of pulses on a raster scan of 1,110 lines using the armed or single-sweep mode to probe in sequence the test points in the system with each point displayed as a separate line on the screen. Manufacturer: Analab Instrument Corp., Cedar Grove, N.J.

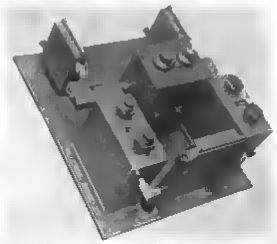
• **Transistorized desk-top analog computer,** Model EAI TR-20, with amplifier computing accuracy quoted at 0.01%, provides high-speed comparator and



electronic switching, with four-channel oscilloscope display for readout of high-speed repetitive solutions. Internally packaged resistors eliminate need for external resistors and permit programming with bottle plugs and patch cords alone, offering easier programming and problem storage. Computer includes variable slope breakpoint function generators and sine-cosine generators. Manufacturer: Electronic Associates Inc., Long Branch, N.J.

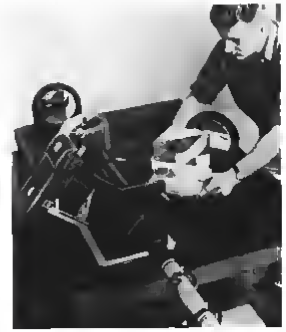
• **Narrow-band ceramic ladder filters,** available with 455-kc center frequency in 6-db bandwidths of 2, 4, 6, 8 and 10 kc, have a 60-db/6-db shape factor of between 1.6:1 and 2.5:1, depending upon bandwidth. The new piezoelectric filters have peak-to-valley ripple of 1-3 db maximum, depending upon bandwidth, and are designed to meet MIL-STD-202B, according to manufacturer Clevite Corp., Piezoelectric Div., 232 Forbes Road, Bedford, Ohio.

• **UHF-to-L-band up-converter,** suitable for use at input to receiver for frequency conversion or for use as an amplifier at



low signal levels, provides two outputs: 1,270-1,410 mc and 1,240-1,380 mc with conversion efficiencies quoted at 9 db and 6 db respectively. Spurious signals in output are suppressed at least 50 db. The device uses tunable filters and varactor multipliers. Manufacturer: Frequency Engineering Laboratories, P.O. Box 527, Farmingdale, N.J.

• **Precision tracking pedestals,** two new models 12 SM and 20 SM with elevation over azimuth heads measuring 12 and 20 in. in diameter, respectively, for mounting antennas or electro-optical trackers, have static position accuracies quoted at better than 0.1 milliradians. Dynamic errors ranging from 0.1 milliradian for low velocity to 0.25 milliradian for velocities of 20 deg/sec have been obtained. Smaller model delivers 50 ft-lb torque on a 125-lb symmetrical load while larger unit delivers 500 ft-lb on a 430-lb load. Pedestal contains low-loss rotary joint for handling RF power. Manufacturer: Barnes Engineering Co., Range Systems Operation, P.O. 1596, Melbourne, Fla.

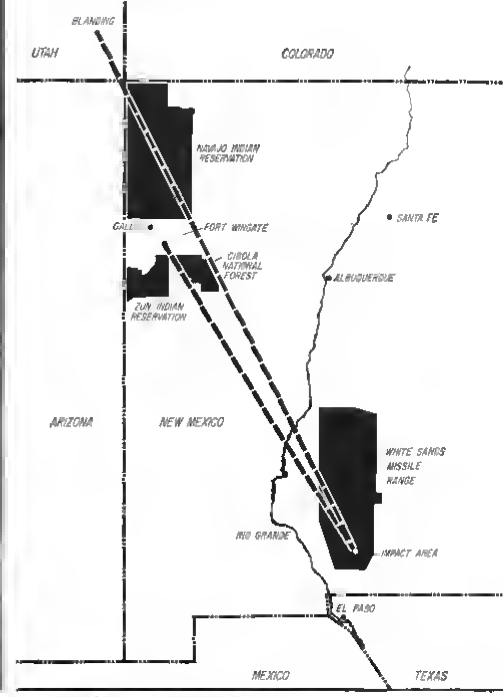


Laser Interferometer

Laser interferometer, using gas laser, provides light sufficiently intense to permit observations of fringe patterns through paths as long as 14 in. in large prisms where formerly mercury arc lamp was limited to glass thickness of about 1 m., according to Perkin-Elmer Corp., which built the device. Laser emits at wavelength of 6,328 A.

"GRADUATION LAUNCH" of a Pershing artillery missile is prepared for by troops of the 4th Battalion, 41st Artillery as a culmination to their training at Fort Sill, Okla. Six batteries—four firing batteries plus a headquarters and service battery—conduct the firing from atop a ridge near Gallup, N. M., firing into an impact area at White Sands Missile Range, 230 mi. away. Launch site is at an altitude of 8,200 ft. above sea level. All key units of Pershing, including the erector-launcher, are mounted on the XM474 tracked vehicles.

PERSHING MISSILE is erected to a vertical position prior to being fired by troops from launch site near Ft. Wingate Army Depot, N. M. The launches, which climax periods of training ranging from 29 to 57 weeks per individual, cost in the area of $750,000 each. The solid fuel 35-ft. missile, weighing 10,000 lb., can be removed from carrier for transport by tactical aircraft or helicopter.



LIFTOFF of the Pershing missile (left) is shown as it begins its flight of about 61 min. to White Sands Missile Range impact area. Map (right) shows launch sites near Ft. Wingate and Blanding, upper left, and broken lines show trajectory to impact areas.

Pershing Crews 'Graduate' With Launches

By Larry Booda

Gallup, N. M.—Army has gained enough confidence in the reliability of the Pershing tactical missile that crews that have completed training have begun 'graduation' firings from a site 12 mi. southeast of here, far removed from a missile range.

The missiles pass over sparsely populated private and public lands to an impact area at the White Sands Missile Range, 230 mi. away. Launch site is a mountain top, 8,200 ft. above sea level. First graduation firing took place Nov. 14, and the second on Nov. 20, was witnessed by the press.

Last of the four firing batteries of the Fourth Battalion of the 41st Artillery, fired its missile Dec. 5. These launches, which cost in the area of $750,000 each, climax periods of training ranging from 29 to 57 weeks per individual, depending on the complexity of the job.

The Pershing first will be deployed to Europe, and then to the Western Pacific. Germany recently indicated its intention to purchase a second battalion of the missiles. Purchase of its first battalion was announced a year ago.

Each firing requires coordination by the range operations office with a number of agencies and individuals. Among these are:

• **Federal Aviation Agency.** Since the Pershing flight occurs entirely within the aerodynamic atmosphere, all commercial, private and military aircraft flights through the missile flight path must be delayed. Ordinarily, the range tries to provide a 30-min. "window"—a period when there will be no air traffic in the danger area. For the Nov. 20 launch, the time was extended 30 sec. because of two holds due to possible range safety hazards.

• **Interior Dept.** This federal agency controls vast land areas in Utah, Colorado, Arizona and New Mexico. In addition, it has direct responsibility for the Indian reservations. The flight path of an alternate launch site at Blanding in southeast Utah, passes over the Navaho reservation, and the Ft. Wingate launch site is close to the Zuni reservation. Interior Dept. passes on all launch information to the reservations.

• **Individuals.** Some small ranches are in the first stage drop area, a wedge-shaped zone extending 25 mi. from the launch site. This is where the first stage crashes, and where the entire missile would land in the event of an abort. Ranchers in this area are paid to leave their homes for a period of hours. Rates vary with the distances traveled and the number of persons involved.

• **Others.** In some instances, state highway departments and railroads have to be notified and traffic stopped for a firing.

The graduation firings were preceded by a series of 14 service test launches by mixed crews made up of Army personnel and technicians of the Martin Co., the prime contractor, and subcontractors. Of these service tests, seven have been made from the Ft. Wingate site, two from Waco on the missile range and two from Blanding. The latter course covers 360 mi.

Graduation firings are made under actual field conditions and a simulated tactical situation. Basic mission of a battery after receiving orders to fire is to go to a pre-surveyed launching site, launch the missile and then move out as fast as possible to avoid retaliatory

fire. The Army calls this the "shoot and scoot" method.

Firing crews, which receive most of their training at Ft. Sill, Okla., are based in field type housing at Ft. Wingate and near the launching site in the nearby Cibola National Forest. Ft. Wingate itself is a small post with limited housing accommodations.

Roads to the firing area have been bulldozed through virgin timber and undergrowth. No attempt was made to clean the equipment that traveled these roads to the mountaintop. All vehicles were mud- and dust-coated.

In the first sequence, the transporter-erector-launcher arrives at the pre-surveyed site. The missile is then raised in its cradle and clamped onto a holding ring. The ring in turn is leveled on adjustable legs. Meanwhile, the power station-programer test station is placed alongside and connected to the missile by cables. At the same time, basic communications links are maintained by the radio terminal.

Readiness timing depends on the training and skill of the crew. Average time is 30 min. As the countdown proceeds, the crew of 12 is gradually reduced to two. At T — 2 the two remaining men take cover behind trees or in foxholes.

Pershing accelerates rapidly after firing, similar to the Polaris and Minuteman ballistic missiles. A rough count of the sequence is as follows: from T — 0 to firing, 9 sec.; first stage burning, 33 sec.; coast period, 18 sec.; second stage burning 20 sec., time from firing to impact 7 min. Apogee is roughly 25 mi. and maximum speed Mach 8.

Accuracy of the Pershing is claimed to be within 10 sec. of arc in azimuth, and hundreds of feet in latitude. Generally speaking, the system need not have pinpoint accuracy because it is designed for nuclear warheads that would be used on enemy concentration points behind the lines.

Prime mover for the Pershing system is the XM-474 tracked vehicle, built by the FMC Corp. The transporter-erector-launcher is carried on an XM-474. The transporter-erector-launcher was designed by the TRW Electromechanical Div. of Thompson Ramo Wooldridge, Inc., and is produced by Unidynamics Div. of Universal Match Co.

The three other major units, also carried on the XM-474, are the warhead section carried on a clamped cradle, the power station-programer test station and the tropospheric scatter radio terminal. Communications equipment is made by the Collins Radio Co.

Both Pershing stages are made by Thiokol Chemical Corp. Casings are fabricated of stainless steel. Inertial guidance system is made by the Eclipse-Pioneer Div. of Bendix Corp. The Pershing is transportable by air in the de Havilland CV-2A Caribou transport and the Vertol CH-47A Chinook helicopter. Warhead fuzing equipment is made by Ford Instrument Co. and Sperry Farragut Co., both divisions of Sperry Rand Corp.

Each battalion has a trainer composed of a transporter-erector-launcher and a missile. The trainer, which looks and acts like the real thing, is manufactured by Hayes International.

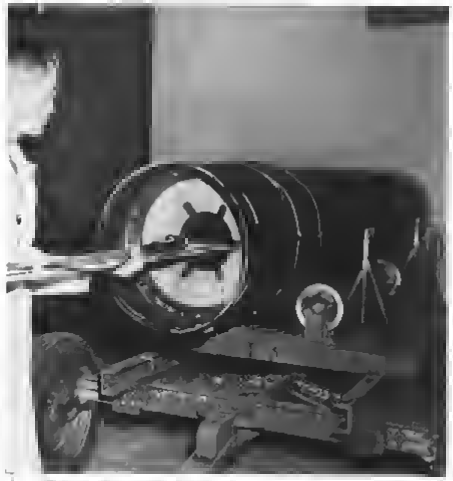
Pershing project manager for the Army is Col. Oliver M. Hirsch. Martin program director is Herman Staudt.

Helium Plant Goes On Stream

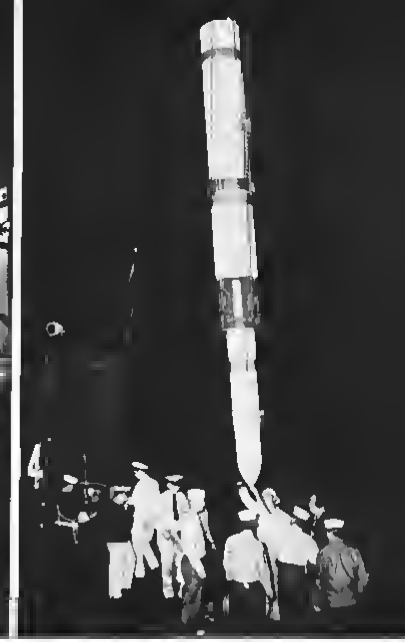
National Helium Corp.'s new helium extraction plant near Liberal, Kans., with a capacity for extracting 1 billion cu. ft. of helium a year from natural gas, is now on stream. Most of the output is expected to find its way into the aerospace field, where it will be used in such applications as pressurizing and purging liquid rocket engines, refrigeration of pipelines and electronic equipment, leak detection and cryogenic pumping.

Test vehicle used in development of rocket-powered Subroc anti-submarine missile (AW Dec 9, p 33) is readied for air drop test at Chuna Lake Calif, Naval Ordnance Station during development testing. Designed to represent the unpowered second stage the drop vehicle unlike the final flight configuration, has a blunt nose, and the area of the aft fins, which here appear fixed, is approximately twice as great

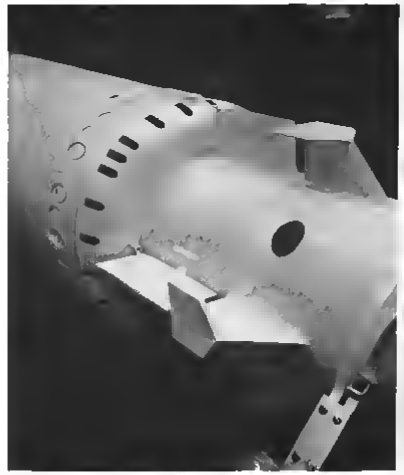
Subroc Anti-Submarine Missile Readied for Navy Operational Evaluation

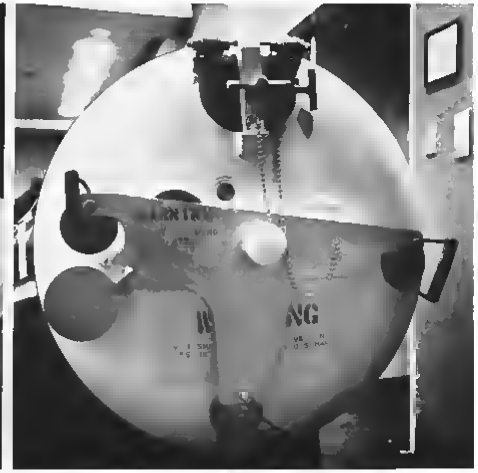


First stage Subroc solid propellant rocket motor (left) is raised from casting pit at Thiokol Chemical Corp's Elkton, Md., plant. Core configuration of the long burning propellant grain can be seen clearly (right) as the motor is readied for radiographic inspection.



Subroc's Mk. 113 underwater fire control system (left), developed by General Precision, Inc., can handle multiple firgets and weapons. Complete, two stage Subroc underwater-to-underwater missile is loaded aboard nuclear powered, 594-class attack submarine, USS Permit, for test firings in the Pacific. Weapon is fired through sub's regular torpedo tubes and will carry nuclear warhead.





Stages are mated (left) at line between closed thrust reversal ports and open connection points in cover behind pivoted aft fins. Other fins are fixed and provide aerodynamic stability. Blow-off cover (right) on aft end of first stage has connections for three umbilicals

Engineering Spectaculars – Fact, not Fiction at Bell Aerosystems . . .

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SPACE AND INFORMATION SYSTEMS DIVISION
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LETTERS

Whose Cape?

Most Americans will applaud President Johnson's action in naming Station No 1 of the Atlantic Missile Range and the NASA Launch Operations Center on Merritt Island the John F Kennedy Space Center as a fitting memorial to the President who ordered this country's greatest leap into space exploration

However, many Americans are also appalled at the arbitrary action of President Johnson in erasing 400 years of geography by also changing the historic name of Cape Canaveral to Cape Kennedy Both the legal and sentimental basis for this change appear nebulous, and set a dangerous precedent for changing basic geographical names in this country with each passing political whim

Cape Canaveral has a proud maritime history dating back to the days when men who sailed with Columbus were still alive. It has a proud space age history as the place familiar throughout the world as the launching site for all this nation's explorations of outer space To obliterate all of this by the stroke of a Presidential pen shows an amazing lack of appreciation of Cape Canaveral's place in history It also indicates a startling disregard for the feelings of citizens of that area It may also arouse such resentment that the original idea of appropriately memorializing the late President Kennedy's strong support of space exploration may be obscured in the bitter controversy that is sure to ensue

When the Army's arsenal at Huntsville, Ala., was named the George C Marshall Space Flight Center in memory of another American whose contributions to this nation's security may bulk larger in history than those of the late president the name of its community, Huntsville, Ala., was left intact.

With a little thought and good taste the same result could have been accomplished in Florida It will be a measure of just how large a man President Johnson really is if he can acknowledge an unfortunate error and return Cape Canaveral to its 400 years of history while retaining the proper memorial to the late President Kennedy in its man made installations

Harry Willison
Bethesda, Md

Think Big

There are many aspects of John Pratt's "How Much?" letter (AW Nov 25, p 126) that will provide subject matter for various reactions One, is that it is obvious Mr Pratt is not thinking 'really big' He does not include the possibilities introduced by also considering the airframe, the engine, the fuel, the electronics, the tires, etc In fact, the only logical conclusion to Mr Pratt's line of reasoning is to eliminate all the "paper profits"

I'm sure such an intellect as Mr Pratt knows where he can find a Utopian society such as he advocates.

Robert K Craig
Bellevue, Wash

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request

Polyot 1 Maneuvering

A recent Aviation Week article (Nov 11, p 28) and Mr Kramer's letter (Nov 25, p 126) raise doubts as to the Soviet Polyot 1 maneuvering claim One cannot dispel such doubts however sufficient data is available to conclude the Soviet claim may be genuine and the "spaceship" may be a maneuverable Vostok prototype.

Although announced to be unmanned, the real question is whether Polyot 1 is a prototype of a manned maneuverable vehicle Since the Vostok is the only known Soviet manned spacecraft it is assumed that if Polyot 1 has a manned capability it is a Vostok with added propulsive capability All Vostoks have weighed about 10 000 lb., therefore it is assumed Polyot 1 weighed roughly 10,000 lb plus the added propulsive weight

It is now questioned whether this heavier vehicle could have been orbited with the Vostok booster vehicle The only announced orbital payloads heavier than the Vostoks are Sputnik 7 and 8, launched February 1961 Sputnik 8 was an announced Venus probe and Sputnik 7 was a probable Venus probe abort Both weighed 14 300 lb and were launched from Tyuratam at 65-deg inclination as were all Vostok launches Since only two launches heavier than Vostok have been announced, and none since February 1961 it is postulated that the Sputnik 7 and 8 booster was not a new larger booster but a modification of the Vostok booster possibly using improved or additional upper stage(s) Therefore, if Polyot 1 was launched with demonstrated booster capability, it must weigh within 14 300 lb

Polyot 1 maneuvering claims, as correctly given by Mr Kramer consisted of a 457 naut mi apogee altitude change and a 6 deg., 5 min plane change (assuming a 65-deg inclination launch)

The question now exists as to whether this maneuvering could be done with a modified Vostok weighing within 14,300 lb Calculations indicate an incremental velocity slightly in excess of 3,000 ft/sec was required for the given maneuvers Assuming a typical propulsion system specific impulse of 275 300 sec., Polyot 1 would have a ratio of initial weight to burnout weight of 1 4 or slightly more If the burnout weight is 10,000 lb (Vostok), then the initial weight is slightly in excess of 14,000 lb, or essentially the weight of Sputniks 7 and 8

Since all previous Soviet launches have been at either 49 deg or 65 deg inclination, and Spadats tracking indicated a 59 99 deg inclination on the first orbit, it is reasonable to conclude that Polyot 1 was launched at 65-deg inclination and plane changes were done prior to Spadats detection This hints that Polyot 1 propulsion may have been more what we commonly term "upper stage" but what still can be properly termed "maneuvering of a spaceship in the cosmos" provided maneuvers are done immediately following orbital injection.

One may doubt the Soviet claims, but, based on the foregoing, one has every right to conclude that the Soviet Union has embarked on another step towards eventual manned rendezvous capability

A Dwight Abbott
Los Angeles, Calif

Hydroskimmer

The pilot report covering the SKMR 1 Hydroskimmer, which appeared on page 68 of the issue of Aviation Week & Space Technology dated Dec 2, 1963 is an excellent description of this country's first large GEM The U S Navy Bureau of Ships should be commended for support of this timely and worthwhile program as well as Bell Aerosystems for an extremely fine job of engineering and design

For the record, I would like to clarify your statement concerning the lift fans General Dynamics Electric Boat had prime responsibility for this system The glass fiber lift fan blades however were designed and built by Parsons Corp After twenty years of successful rotor blade production for the helicopter industry, we are also proud to have contributed to the over-all success of this new cushion vehicle

J M O'Hara
Sales Manager,
Research & Engineering
Parsons Corp
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Traverse City, Mich

Cover Glass on IMP

In the article "IMP Will Warn of Dangerous Solar Flares" (AW Nov 4, p 28), it is stated that Radio Corp of America built the radiation-resistant cover glass used to protect the silicon cells from damage caused by solar protons This statement is in error Optical Coating Laboratory, of Santa Rosa, Calif., manufactured the cover glass used on IMP just as it has manufactured this type of cover glass for most of the larger satellite systems which have been built over the past three years

Danforth Joslyn
Vice President
Optical Coating Laboratory, Inc.
Santa Rosa, Calif

(Optical Coating Laboratory supplies Spectrolab Div Textron Electronics, Inc with 12 mil 0211 microsheet glass made by Corning Glass for incorporation in the solar panels Hehotek Div of Textron Electronics Inc incorrectly credited in the story for the solar panels, actually supplies the silicon cells —Ed.)

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